THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVIII. No. 1473.] LONDON, AUGUST 4, 1891. [43RD YEAR. Price 6d.

WOLSTON'S Paste and Ready Mixed for Use.

Guaranteed Free from Adulteration. **TORBAY PAINTS.**

FOR GASHOLDERS, &c., &c.

The Original "Torbay Paints"
As supplied during the present and many preceding years to the LONDON GASLIGHT & COKE COMPANY.

Special Quotations to Gas Companies.

TORBAY & DART PAINT Co., Ld.,
23, Gt. George St., Westminster, S.W.
Works: DARTMOUTH, DEVON.

— ESTABLISHED 1830. —
PARKER & LESTER,
Manufacturers & Contractors.

THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.

Ashmore, Benson, Pease, & Co., Ld.,
STOCKTON-ON-TEES,
Manufacturing Gas Engineers.
See Advertisement, p. 230.

CEMENT
EARLE'S
BEST
Portland Cement
MANUFACTURED BY
GEO. & THOS. EARLE,
HULL.

Offices: 7, 8, & 9, PIER STREET.
Works: WILMINGTON.
STOREAGE CAPACITY 10,000 Tons.

ESTABLISHED 1811—OVER THREE QUARTERS OF A CENTURY.
Telegraphic Address: "CEMENT HULL."

NORTON'S PATENT
"ABYSSINIAN" & ARTESIAN TUBE WELLS,
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.
LE GRAND & SUTCLIFF,
HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

SELF-CONTAINED DUST-FUEL FURNACE.
MELDRUM'S PATENT.

Extract from the *Smethwick Telephone,* June 13, 1891.

GAS COMMITTEE.

"The Manager [B. W. Smith, Esq.] reported that the adoption of MELDRUM'S PATENT FURNACES, he estimated, had resulted in a saving of 150 tons of Slack during the nine months they had been at work in the Boiler-House, and 360 tons of Slack during four months in the Retort-House; the fuel used in place of slack being the fine coke dust which formerly had to be carted or boated away at considerable expense."

MELDRUM BROS., Engineers,
ATLANTIC WORKS, 13, CITY ROAD, MANCHESTER.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765),

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

EDWARD COCKEY & SONS, LIMITED,

ENGINEERS & CONTRACTORS FOR GAS-WORKS.

TELEGRAPHIC ADDRESS: "COCKEYS FROME."

THE IRON-WORKS,
FROME.

Messrs. COCKEY desire to draw the attention of Gas Engineers and Managers to their new form of GAS WASHER, which, by a recent patent, converts their HORIZONTAL Washer into one of a VERTICAL form.

The principle is the same as in the horizontal one, which has now been before the profession for a number of years, and where adopted is giving unqualified satisfaction.

The Washer is entirely automatic in its action, and does not therefore need any motive power—an advantage which will be apparent to all.

It is made in all sizes, from **25,000 TO 3,000,000 FEET PER DAY**; and Messrs. COCKEY invite inquiries, which shall have early attention.

March, 1891.

PRICES ON APPLICATION TO THE SOLE MAKERS.

THE IRON-WORKS, FROME SELWOOD, SOMERSET.

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

—11 MEDALS.—

MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

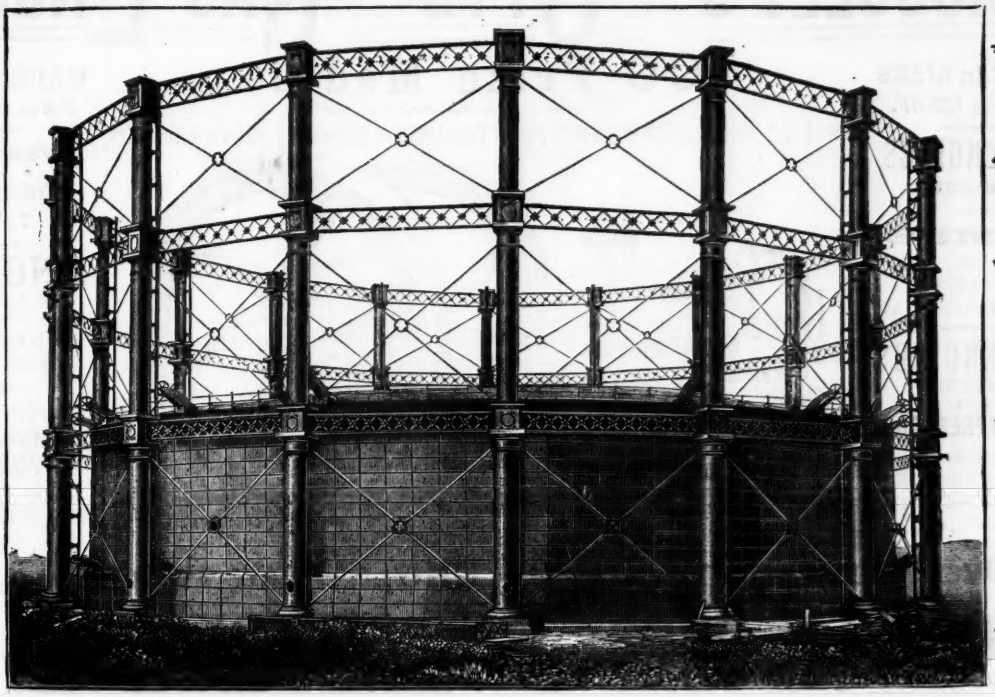
SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

LONDON: 108, Southwark Street.
BIRMINGHAM: 114, Colmore Row.
LEEDS: 6, Mark Lane, New Briggate.

THOMAS PIGGOTT & CO., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS, BIRMINGHAM.

WELDED & RIVETED PIPES, FOUL MAINS, RETORT LIDS, WROT & CAST TANKS, PURIFIERS.

OVER 500 GASHOLDERS HAVE BEEN SUPPLIED AND ERECTED,

INCLUDING THOSE SUPPLIED TO THE FOLLOWING GAS COMPANIES AND CORPORATIONS:

BATH.	BOLTON.	BRISTOL.	CHELTENHAM.	LEAMINGTON.	PRESTON.	SHEFFIELD.
BELFAST.	BOMBAY.	BRISBANE.	HARTLEPOOL.	LIVERPOOL.	READING.	STOCKHOLM.
BECKTON.	BRADFORD.	CARDIFF.	LEEDS.	NOTTINGHAM.	RIO GRANDE.	SYDNEY.
BIRMINGHAM.	BRIGHTON.	COVENTRY.	LEICESTER.	OLDHAM.	SOUTH METRON.	VIENNA.

GAS COAL.

BEST

REAL OLD SILKSTONE GAS COAL,

Address, THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

NEWTON, CHAMBERS, & CO., LIMITED

THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

SLIDE VALVES, WITH RACK & PINION, OR Internal or External SCREWS, of all Sizes.

GASHOLDERS, AND Gasholder Tanks.

CAST-IRON RETORTS,

RETORT-BED FITTINGS,

And Retort-House Appliances

of every description.

Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.

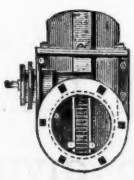
WROUGHT AND CAST IRON CONDENSERS, SCRUBBERS, & WASHERS,

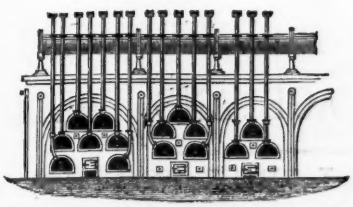
TAR AND LIQUOR PUMPS, &c.

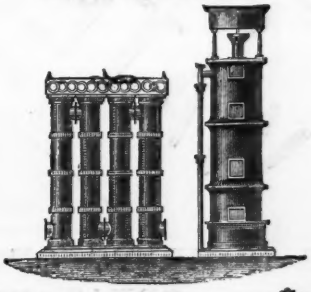
PATENT CENTRE VALVES

for working Purifiers.

Also Bye-Pass & Stop Valves.





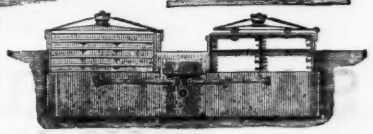


PURIFIERS with Planed Joints,

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS,

WOOD GRIDS.

CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

CROSSLEY'S "OTTO" GAS-ENGINE.

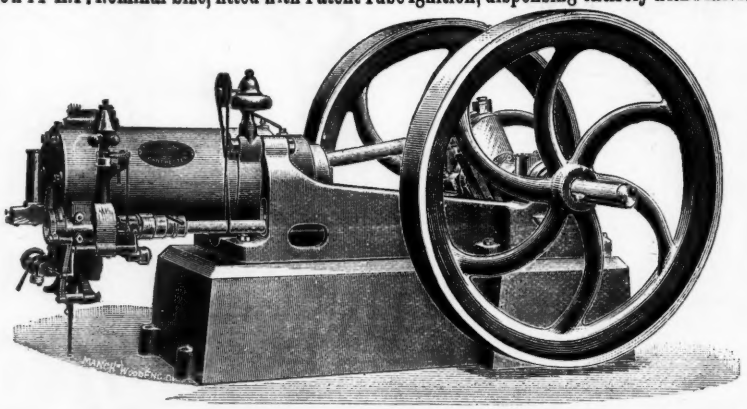
100 Prize Medals.

MADE in SIZES
2-Man to 100-HP.

GAS-ENGINES
COMBINED
WITH
PUMPS
FOR
TOWNS SUPPLY,
SEWAGE, &c., &c.

GAS-ENGINES
COMBINED
WITH
AIR COMPRESSORS
FOR THE
SHONE SEWAGE
SYSTEM LUCIGEN
LIGHT, &c.

New 14-H.P. Nominal Size, fitted with Patent Tube Ignition, dispensing entirely with Plates.



MADE in SIZES
2-Man to 100-HP.

VERTICAL
AND
HORIZONTAL
TYPES.

ENGINES
COMBINED
WITH
HOISTS, PUMPS
DYNAMOS, &c., &c.

Largely used for
EXHAUSTING,
PUMPING,
COKE CRUSHING,
ELECTRIC LIGHTING,
&c., &c.

Over 31,000 "OTTO" ENGINES are at work.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER,

LONDON,
LIVERPOOL,
GLASGOW,
NEWCASTLE,
BIRMINGHAM,
HULL.

HARRIS & PEARSON,
STOURBRIDGE, ENGLAND.
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

LEAKY AND STICKING SLIDES
ENTIRELY AVOIDED.

EASILY MANIPULATED.

ESPECIALLY SUITABLE FOR PURIFIERS.

CUTLER'S PATENT WATER-VALVES FOR PURIFIERS.

LEAKAGE IMPOSSIBLE.

NEAT AND COMPACT.

NO DETERIORATION THROUGH
AGE AND FREQUENT USE.

IN USE AT NUMBERS OF LARGE WORKS, AND GIVING GREAT SATISFACTION.

SAML CUTLER & SONS, Engineers,
GAS AND WATER WORKS CONTRACTORS.

WORKS:
PROVIDENCE IRON-WORKS, MILLWALL, LONDON, E.
Telegrams: "CUTLER, MILLWALL, LONDON." *Telephone:* 5059.

OFFICES:
16, GT. GEORGE STREET, WESTMINSTER, S.W.
Telegrams: "RETORTUS, LONDON," *Telephone:* 3223.

A.B.C. CODE USED, 4TH EDITION, 1883.

JOSEPH CLIFF & SONS,

INCORPORATED IN THE LEEDS FIRE-CLAY COMPANY, Ltd.,

WORTLEY, LEEDS.

LONDON Offices & Depôts:
Baltic Wharf, Waterloo Bridge.

WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.

LIVERPOOL:
16, Lightbody Street.

LEEDS:
Queen Street.

MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

ESTABLISHED MORE THAN A QUARTER OF A CENTURY

WORKS HUNSLET, LEEDS

LONDON OFFICE: 60, QUEEN VICTORIA STREET E.C.

CLAYTON SON & CO. LTD.

MAKE A SPECIALTY OF GASHOLDERS

AND MAKERS OF GAS PLANT OF EVERY DESCRIPTION.

REG^D TELEGRAPHIC ADDRESS: "GAS LEEDS"

THE WIGAN COAL & IRON CO., LIM^TD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

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R. & J. DEMPSTER,

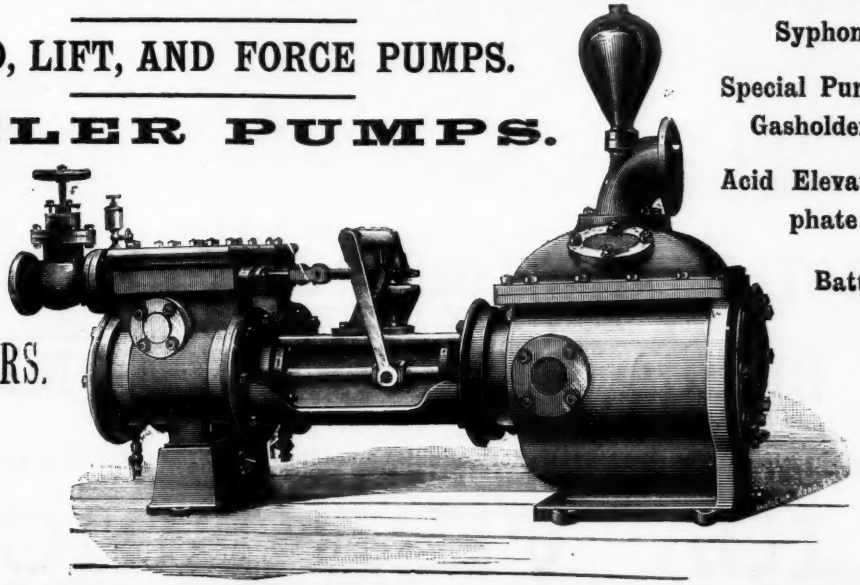
Engineers, Ironfounders, and Contractors,

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.

HAND, LIFT, AND FORCE PUMPS.

BOILER PUMPS.

PUMPS For SCRUBBERS.



Syphon Pumps.

Special Pumps for deep Gasholder Syphons.

Acid Elevator for Sulphate Plants.

Battery Pumps.

DUPLEX PUMPS FOR TAR, AMMONIACAL LIQUOR, OR CLEAN WATER.

LONDON OFFICES: 181, GRESHAM HOUSE, OLD BROAD STREET, E.C

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.

Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

Telegrams: "ATLAS SHEFFIELD."

The best Stove made for Hiring out purposes. Can be taken to pieces readily.

Richmond's Cast-Iron and Enamel "Model" Gas Range.

UNSWORTH & RICHMOND, LTD.,

GAS APPARATUS MANUFACTURERS,

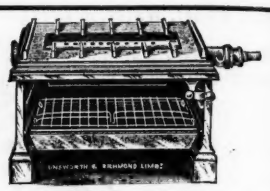
WARRINGTON.

This "Model" Range has been signally successful! So large a demand having been created for it, we have now for the second time in Twelve months enlarged our Works to meet the press of orders.

1.—Its chief advantage for hiring out is: All Oven Fittings, Hot Plate, Hot Plate Burners, Jet Cocks, and Gas Bar, easily removeable for Cleaning.

2.—To the General Public: Clean and neat appearance, Special Simmering Burners, Blue and White Enamel, Hot Plate Burners lift out to clean. No screws. Economical and Simple.

3.—The above points are confirmed by Nelson Gas Committee's test, June 3, in which U. & R's. "Model" Range beat Wilson's, Wright's, Davis's, and three other makers for Roasting, Baking, &c., and won first place against all competitors.



Quick Lever Grill.
No. 200 10×9×7½, 7/-. No. 205 12½×11×8, 10/-.

Burners suitable for heavy work.
No. 300 12ft., 2/6. No. 302 16ft., 3/6. No. 304 20ft., 4/6.

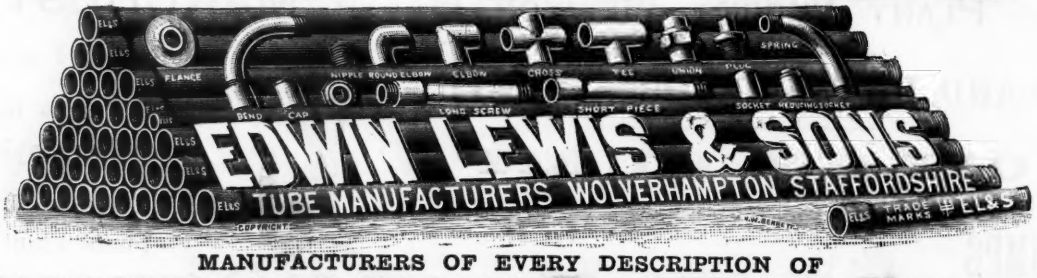
As Block. No. 306, 1/8 No. 308, 2/6
Plain Reeded Rim. No. 313, 1/6 No. 314, 2/6 No. 315, 3/6

No.	Inside Dimensions of Oven.			Hot Plate.	Height over all.	Burners on Hot Plate.	For family of	Price unpacked.	Packed and Enamelled.
* 30	11in.	11in.	17in.	17½in. × 17½in.	28in.	2	2	£2 10 0	£3 0 0
* 40	12in.	12in.	20½in.	16½in. × 16½in.	28in.	3	4	3 0 0	3 10 0
* 50	12in.	12in.	25in.	18½in. × 18½in.	32in.	3	5	3 10 0	4 0 0
100	14in.	18½in.	28½in.	24in. × 22in.	36in.	4	6		5 15 0
120	16in.	16in.	28½in.	25½in. × 23½in.	36in.	5	10		7 0 0
140	18in.	18in.	28½in.	28in. × 26in.	36in.	6	15		9 0 0
160	22in.	21in.	32in.	31½in. × 30in.	41½in.	7	25 to 30		13 0 0

* These smaller sizes are not fitted with loose Burners at present.

ESTABLISHED 1825.

GAS TUBES



MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

THE SILICA FIRE-BRICK COMPANY,

OUGHTYBRIDGE, NEAR SHEFFIELD.

Established 1858. The First Manufactory of Silica and Dinas Fire-Bricks erected in England.

MANUFACTURERS OF

SILICA FIRE-BRICKS,

(TRADE MARK "SILICA")

Specially adapted for Siemens-Martin Gas-Furnaces; also for Gas, Copper, Iron, Steel, and other Furnaces where intense heat is required.

BESSEMER GANNISTER, STEEL-FURNACE GANNISTER, COPPER-FURNACE GANNISTER, IRONFOUNDERS' CUPOLA SAND, FINE-SETTING SILICA CEMENT, STEEL MOULDERS' COMPOSITION.

Our Silica Bricks have gained a high reputation for Unsurpassed Quality in most of the leading Firms in England and on the Continent. Export orders delivered Liverpool, Hull, Grimsby, or the Tyne.

KIRKHAM, HULETT, & CHANDLER, LIMITED.

[Mr. SIDNEY HERSEY, Managing Director.] ADDRESS AT FOOT. [Mr. J. CHANDLER, Engineer.]

416 Patent "Standard" Washer-Scrubbers,

Equal to a Daily Capacity of 374,700,000 Cubic Feet of Gas,

Erected and in course of construction at present date, amongst them being the following, viz.:—

(All new machines are supplied with improved wooden washing devices—"Bundles"—which can also be fitted to old Washers).

	Capacity. Cubic feet per day.
Altrincham	600,000
Adelaide	600,000
Aldershot	200,000
Allegheny, U.S.A.	1,000,000
Ashton-under-Lyne	1,250,000
Amsterdam	1,500,000
"	1,500,000
Annaberg	200,000
Arcachon	100,000
Animal Charcoal Co.	200,000
Altoona, U.S.A.	350,000
Buxton	250,000
Bradford	1,000,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,000,000
"	1,000,000
"	3,000,000
"	150,000
Bremen	1,000,000
Baltimore, U.S.A.	1,000,000
"	1,000,000
Balmain, N.S.W.	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
"	1,250,000
Banbury	250,000
Birmingham	5,000,000
Birkenhead	2,500,000
Blackburn	1,500,000
Bochum	600,000
Burntisland	250,000
Boston, U.S.A.	2,000,000
Brisbane	1,500,000
"	300,000
Burton-on-Trent	1,500,000
Barcelona	350,000
Barking	100,000
Baerlien & Co.	20,000
"	420,000
Bombay	700,000
Buffalo, U.S.A.	550,000
"	500,000
Brooklim, U.S.A.	300,000
Bergen	250,000
Berlin	150,000
Bournemouth	1,000,000
Bridgeport, U.S.A.	500,000
Brunswick	300,000
Beck & Co., St. Louis	100,000
Barmen Rittershausen	600,000
Bexhill	125,000
Brooklyn, U.S.A.	1,000,000
"	1,000,000
Brunner, Mond, & Co.	400,000
Cheltenham	2 000,000
Cannes	200,000
Croydon	1,500,000
Copenhagen	200,000
Clevedon	200,000
Columbus, U.S.A.	500,000
Cincinnati, U.S.A.	1,500,000
"	1,500,000
Chicago, U.S.A.	3,000,000
"	1,000,000
"	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas-Works Co.	100,000
Cadiz	300,000
Charottenberg	600,000
Dudley	750,000
Driffield	100,000
Dukinfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
Derby	1,500,000
Dublin	3,000,000
Dowlais	100,000
Douai	500,000
Denton	500,000
Derby, U.S.A.	350,000
Denver, "	500,000
" "	1,000,000
Düsselldorf	750,000
"	500,000
Dumfries	250,000
Dunedin, N.Z.	400,000
Darlington	1,250,000
Detroit, U.S.A.	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshütte	500,000
Fürth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
Guildford	300,000
Gloucester	1,250,000
Gera	300,000
Grafton, N.S.W.	100,000
Grieg	300,000
Georgetown, U.S.A.	250,000
Gluckauf	200,000
Heywood	600,000
Holywood	125,000
Huy	70,000
Harrow	250,000
Harrogate	250,000
Halstead	150,000
Heilbronn	200,000
Havanna, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Heckmondwike	500,000
Haverfordwest	100,000
Halifax, N.S.	350,000
Hamm	200,000
Halle	400,000
Heidelberg	300,000
Hartford, U.S.A.	1,000,000
Ilkeston	300,000
Inverness	250,000
Ilkley	200,000
Ilford	100,000
Kingston-on-Hull	400,000
Kidderminster	750,000
Kidsgrove	100,000
Königsberg	1,000,000
King's Lynn	300,000
LONDON:—	
The Gaslight and Coke Co.:—	
Beckton	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000
Shoreditch	2,500,000
LONDON—*Continued.*	
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms (2)	3,000,000
Kensal Green (2)	3,000,000
South Metropolitan Co.:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
"	3,000,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	560,000
"	600,000
Liverpool	2,000,000
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" (3)	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U.S.A.	1,000,000
Laclede, "	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lille	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U.S.A.	250,000
Lawrence, "	500,000
Lynn, "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
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" "	750,000
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Sunderland	1,500,000
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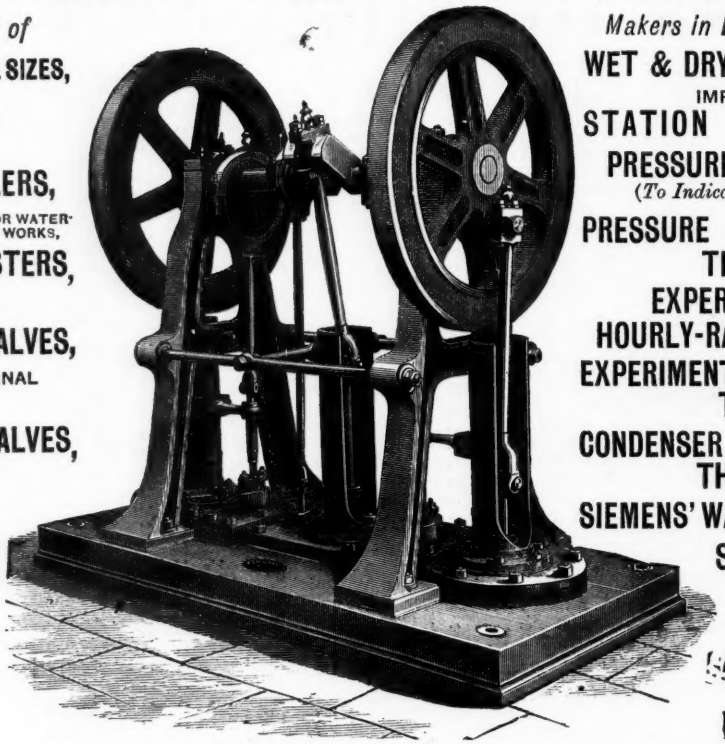

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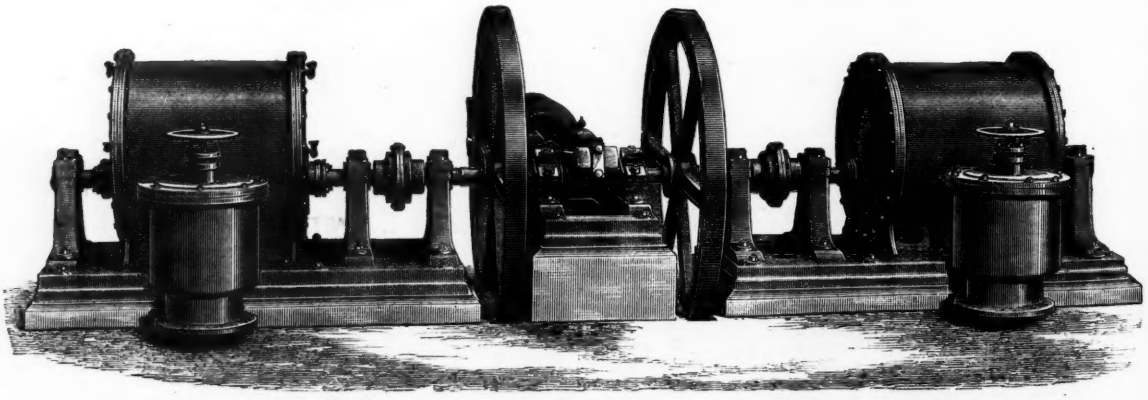

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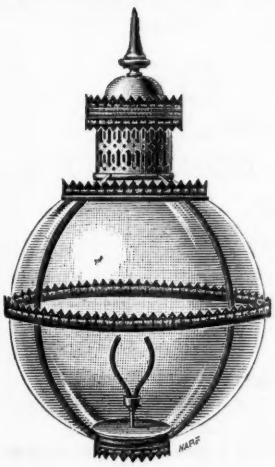

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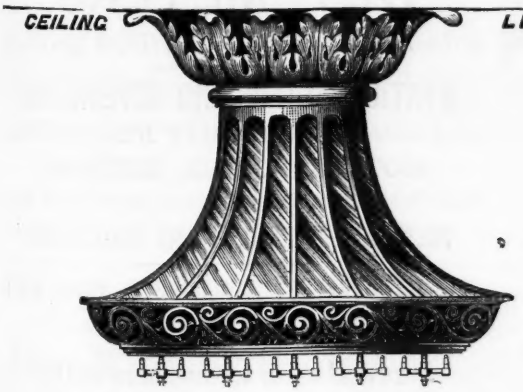

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[See also Advt., p. 198.

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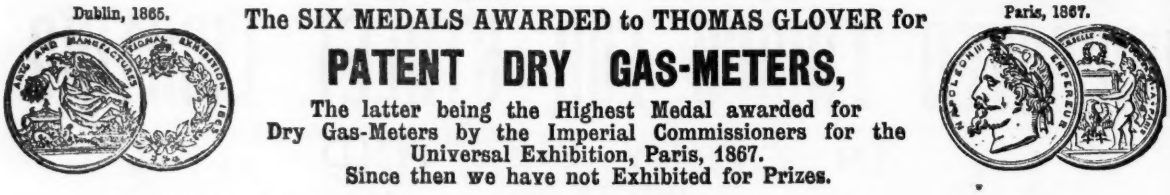

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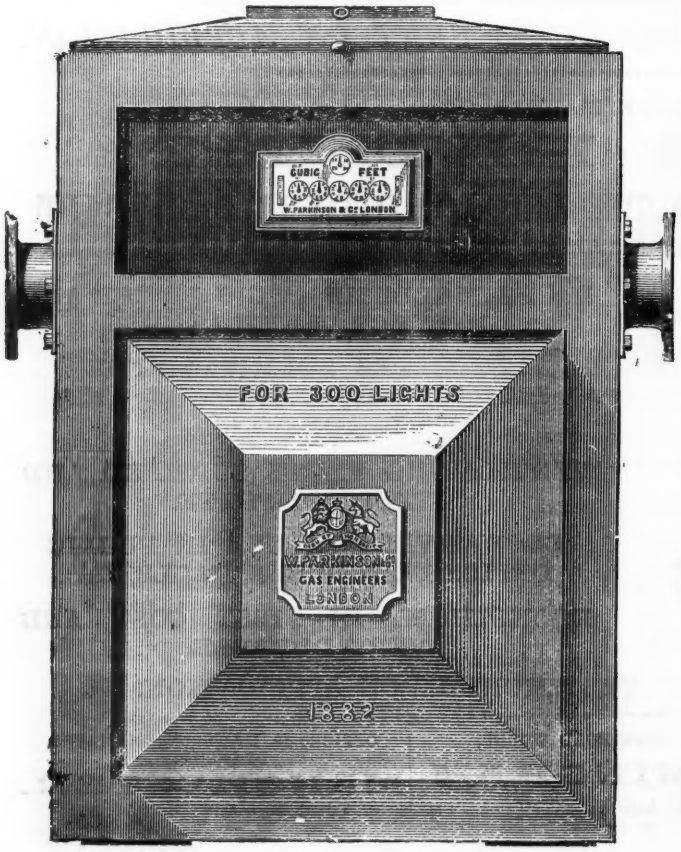

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[See also Advt., p. 197.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

TO ADVERTISERS.

ADVERTISEMENTS for the next number of the JOURNAL must be received by Monday, 12 o'clock noon, to ensure insertion; but **Orders for Alterations in or Stoppages of PERMANENT ADVERTISEMENTS should be received Not Later than the FIRST POST on SATURDAY.**

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, AUGUST 4, 1891.

The Report and Accounts of The Gaslight and Coke Company.

THE usual reports and the statement of accounts relating to the past half-year's working of The Gaslight and Coke Company have been issued, in preparation for the general meeting on Friday next. The preliminary announcement that the Directors intend to recommend the payment of a dividend after the rate of 13 per cent. per annum has heightened rather than allayed the curiosity with which the interested portion of the public has awaited the appearance of these accounts, especially as there was no reference in this announcement to the state of the Company's finances. When there is a balance to be carried forward, the fact is always published. But nobody expected the Company to be in so good a position at this time; and the only subject of speculation was as to the extent to which the reserve fund would have to be drawn upon to make up the dividend. It now appears that this fund must be reduced by £159,845 for the purpose; leaving a balance of only £232,069. This is a state of things which is neither to be lightly passed over nor treated in the style of an alarmist. The Directors have done rightly respecting it by putting the fact in the forefront of their report; thereby challenging observation and remark, instead of attempting to hide it as if it were something to be ashamed of. Critics of the Company belong to many orders; but those who study the financial aspect of this great undertaking, when they see that the dividend is not earned, naturally refer the interpretation of the fact to one of two general causes—either the business must have fallen off, or it has been carried on at greater expense than the production of a satisfactory balance permits. It is with sincere satisfaction that we are able to point out that the former of these reasons does not apply in the present case. The consumption of gas in the district of The Gaslight and Coke Company, so far from having been injuriously affected by the competition of other means of lighting, or from gas lighting having fallen into disrepute, shows the exceptional increase of nearly 10 per cent.; involving the provision of additional plant to meet it. The report states that the growing demand for gas appears to be to some extent attributable to daylight consumption for warming and cooking stoves, and also for "mechanical "motive power." While any increase in the demand for gas for these purposes is, of course, a good thing, it is a mistake to magnify it at the expense of the increased demand for light, which is something very much better worth talking about, in view of existing circumstances. The remaining reason for the diminution of the Company's profits must therefore hold good. But this is a matter for internal solicitude. If the Company's business rivals had succeeded in making an impression upon their resources, the consideration would have been something very different from that with which we are actually brought face to face. Business being better than ever, therefore, why is it that it does not pay so well?

Let us examine the figures. The Company receive for the half year the splendid revenue of £1,363,835 for gas alone. Meters and stoves returned more than ever; and all kinds of residuals show a substantial increase. Coke went up from £241,225 to £313,337; tar rose from £109,562 to £121,483; and ammoniacal liquor and sulphate improved from £76,755 to £82,667. Altogether, the gross revenue shows an increase from £1,615,631 to £1,928,649, or no less than £313,018. Where the concern would have been without this substantial improvement in the income need not be said. Unfortunately, on the other side of the account there is a really serious revelation of swollen expenditure. The Company spent £1,547,923 in order to carry on their work, as compared with £1,284,935 for the corresponding period of 1890; being an increase of £262,988. Notwithstanding this fact, the profit balance is upwards of £50,000 better than it was a year ago, thanks to the increased price of gas. The outlay for coals rose from £701,429 to £902,074, every ton of which stood the Company in the exorbitant price of 16s. 4·72d. How they came to incur such an enormous cost for coal is a query that calls for a more satisfactory answer than any explanation yet offered of the fact, whether across the Directors' table, in a Court of Law, or in the form of an inspired communication to a newspaper. Carbonizing wages, again, have risen from £169,558 to £193,394 for the half year. This charge now amounts to upwards of 3s. 6d. per ton of coal carbonized. The increased weight of coal dealt with, as compared with the corresponding half of 1890, is 140,600 tons, which not only had to be purchased at the enhanced price shown to have governed the contracts running at the time, but cost £23,836 to carbonize, or an increased charge for wages amounting to more than 4s. 1d. per ton. Thanks to some cause, the nature of which the Governor (Colonel Makins, M.P.) will doubtless explain to the proprietors on Friday, the more work the Company have to do, the more it costs them to do it. Evidently, the faster the Company's Engineers can hurry up the various labour-saving appliances with which they are experimenting, the better.

The Directors can hardly be accused of starving their works and distributing plant, for the outlay upon this object shows a steady rise. Everything else, however, is manifestly cut down to the lowest point; the engineering and clerical expenses being practically constant,

notwithstanding the regular growth of the business, and therefore of the amount of work thrown upon the staff. An interesting passage of the report refers to the substitution of oil for cannel for carburetting purposes; and the accounts show that 2378 tons of oil have been used for the purpose. This statement marks the dawn of a new era of the manufacture of 17-candle gas from Newcastle coal. It is known that while 15-candle gas may be made from this kind of material without real difficulty, 16 candles can only be attained with exceptional care and precaution. Although London gas is reputed to be of 16-candle quality, the principal works are now so far from the centres of consumption, and the Referees have grown so fidgety on the subject of photometers, that the gas has to be made of at least 17-candle power—some people say 17½ candles—if the Companies are to keep out of trouble. That this extra value should be imparted to the gas by oil instead of cannel is a change which many gas managers never expected to witness in their time; and the fact deserves to be duly signalized. The report now under notice proceeds to refer to the water-gas experiments undertaken by the Company's Engineers; and it is stated that "the Directors "are utilizing some of the patents for water-gas manufac- "ture." Unless we are under a wrong impression, this expression is not quite accurate. The apparatus mainly employed by the Directors for the production of carburetted gas is not patented in this country; so that anybody who likes can use it.

The report goes on to refer to the Company's assessment appeals, which are now in course of hearing, as will be seen by the beginning of our special report in another column. Awkwardly enough, the hearing is to be resumed on Friday next—the same day as the general meeting; so that the proprietors will not be able to learn from the Governor how matters are going. This appeal is a very heavy business, not so much on account of there being anything new in the fact of a Gas Company endeavouring to get their valuation reduced, as because of the magnitude of the interests involved, and, in some respects, the novelty of the issues raised. Altogether, Friday's meeting ought to be an interesting event, if the position and prospects of the Company receive only half the explanation and discussion which the circumstances warrant. We cannot quit the subject of the Chartered report without a word on the change in the directorate consequent upon the lamented death of Mr. Stephenson Clarke. In selecting Mr. J. Birch Paddon to fill the vacancy, the Board may be credited with a piece of sound judgment; and the proprietors are to be congratulated on having thus obtained the services of one of the most respected gas administrators of the day. Mr. Paddon's accession distinctly strengthens the Board.

The London County Council and the Standard of Light.

Last week we published a lengthy extract from the report of the London County Council for the past year, including all that portion of this statement which bears upon the subject of gas supply. The chief topic for comment is that of the proceedings of the Council with regard to the official tests of illuminating power. The Council admit that the standard of light under the present Gas Acts is unreliable; and they place upon record the protest of the Gas Companies against the want of uniformity in the design of the photometrical instruments employed against them. The report relates the steps taken to move the Board of Trade in the matter of amending the law of gas testing, at least so far as the improvement of the legal standard of light is concerned; and it contains an expression of regret that the Department had done nothing in the direction indicated. Whether or not this declaration of the views of the Council had any effect upon the official mind it would be impossible to say; but, curiously enough, the report no sooner saw the day than a communication on the subject of gas testing came from the Board of Trade to the Sanitary and Special Purposes Committee of the Council, as reported in another column. It appears from this pronouncement that, while the Board of Trade have no particular objection to the Council moving in the matter, they think it advisable to appoint yet another Scientific Committee "to consider what the standard of light should "be;" and they suggest that the Council should bear the expense of such a Committee. The Council met the suggestion with a polite, but decided, *non possumus*. In the first place, they did not consider that the settlement of the Imperial standard of light is any business of theirs; and, secondly, there are no funds upon which such an expense could be charged. Nevertheless, while declining to have anything to do with a Committee appointed by the Board of Trade, the Council have decided that they know quite enough of the question to go to Parliament about it; and so they have instructed their Parliamentary Committee to prepare a Bill for next session, "for substituting a more "exact standard of light for that now prescribed by the "principal Gas Companies' Acts." This means that the legalization of the pentane standard, and probably of the Methven equivalent, is to be asked for next session; in which event, the Gas Companies will probably have something to say upon the general question. We should like to know why the Board of Trade wish to refer the subject of the standard of light to another Committee; and also whether they will think it necessary to oppose the County Council, who have decided that, in regard to this matter at least, "London cannot wait."

The Examinations in Gas Manufacture.

The result of the last City and Guilds of London Institute Examination in Gas Manufacture has been communicated to us, together with the questions papers, by the Superintendent (Sir Philip Magnus); and the pass-lists will be found in another column. The Examiner was Mr. Charles Hunt, M. Inst. C. E. We have no space this week for any comment upon his papers, beyond the general observation that they do not tend to grow easier with the progress of time; but we shall perhaps have another opportunity of discussing this subject. For the present it must suffice to note that the winner of the First Prize in the Honours Grade, First Class—a silver medal and the Salters' Company's prize of £2—is Mr. Robert Watson, of London. The First Prizeman and Silver Medallist of the Ordinary Grade, First Class, is Mr. R. A. Dry, of Birmingham; the Second Prizeman being Mr. H. H. Gracie, of Edinburgh. The medals in the Ordinary Grade were each accompanied by the Salters' Company's prize of £1. We gladly take this opportunity for modifying the passage in our last week's editorial references to these examinations, in which (following the President of the North British Association of Gas Managers) we deplored the smallness of the part played by Scotch students in these honourable and useful competitions. As a matter of fact, the fault was corrected before it was noticed; for Scotland furnishes a goodly proportion of the successful candidates who presented themselves for examination in April. It is to be hoped that the same thing will be observable again. Not only Scotland, but England and Ireland also, ought to support these examinations better; for there can be no question of the truth that the possession of a pass certificate of the City and Guilds of London Institute is one of the most potent recommendations for employment in a responsible position that a young man aspiring to a place in the higher regions of gas-works administration can exhibit. It is not everything, of course, but it is a good deal.

The Autumn Meeting of the Institution of Gas Engineers.

As briefly announced last week, Mr. T. Cole, Assoc. M. Inst. C. E., the Secretary of the Incorporated Institution of Gas Engineers, has issued his preliminary notice respecting the autumn meeting of the Institution, with a request for papers to be read on the occasion. The warning possesses the force of novelty; an autumn session of a national Gas Engineers' Association being a new experiment. We hope it will prove a successful one; and we express the aspiration the more freely, inasmuch as the desirability of gas engineers meeting more frequently than once in a twelvemonth has long been maintained in these columns. It is to be noted that the Liverpool meeting will occupy Tuesday and Wednesday, the 13th and 14th of October, which will be ample time for the reading and discussion of half-a-dozen good papers. The spring meeting of the Institution was conspicuously successful in regard to discussions; and there is no reason why the same satisfactory result should not be secured in Liverpool. The list of suggested subjects for papers, which forms a prominent part of Mr. Cole's circular, is hardly so fresh-looking as might have been desired; for unless a category of this order is kept up to date, it is of small utility. The list reads better, however, if it is understood as being descriptive of some of the classes of subjects which come within the purview of the Institution, rather than as suggested titles for papers. It is extremely difficult to impart an air of novelty to the names of standard dishes, whether of

material or intellectual fare; and so we cannot blame the Council seriously for the familiar appearance of many of their suggested subjects for technical communications. It is more to the purpose to note that authors are desired to write in the third person. We presume that the remark of the circular that "papers should be written in the third "person" is meant as a recommendation, not for a cast-iron rule. There is much to be said for the spirit of such a caution, as tending to discourage the excessive use of the first person singular by authors of papers. Some papers we have seen are as thickly studded with I's as an article by a "society" journalist; but the wearisomeness of this egotism is only intensified when the reader is perpetually referring to himself as "the writer," and has to turn all his I's into he's. An egotist will be an egotist still, whatever the form of grammatical expression to which he is restricted. Taking the holidays into account, there is not too long an interval between now and the regulation three weeks before the date of the meeting, by which time papers ought to be deposited. But it is to be hoped that the Council will keep to the spirit of this regulation, and not permit authors to abuse their good nature by rushing in contributions at the eleventh hour, as is sometimes done, to the great injury of the society which allows it.

A Question of Title.

THE articles of the JOURNAL, dealing as they do with subjects of world-wide interest, have a corresponding circulation; and it is always a cause of gratification to us when matter which first sees the light in our pages is reproduced by Colonial, American, or Foreign contemporaries. Naturally, the pleasure and pride with which we note this supererogatory publication of our essays, paragraphs, &c., is enhanced when proper acknowledgment of the source of the matter is made by the papers which borrow it. It is a principle upon which we always endeavour to act in regard to the republication of any literary material of foreign origin, that if an article or a piece of technology is good enough to reproduce, it is equally worth acknowledging. This working principle is ignored by the conductors of some journals who ought to know better; and we are often amused by marking the travels of paragraphs, &c., which, originally appearing in our pages, go afterwards all round the world either sponsorless, or ascribed to some periodical which merely happened to copy them first. The journals devoted to the gas industry, however, when copying articles of general interest from our columns for the benefit of Continental or American readers, seldom fail to acknowledge the source of the matter. The remarks just made, therefore, upon a variety of journalistic piracy which is only too common, do not apply to the gas journals of all nations, which we hope to see continuing in the way of borrowing anything they may deem suitable from us, as we do from them. At the same time we have a little grievance in connection with this subject, which may as well be uttered now as at any other time. It is that some of our journalistic compeers, particularly of America, insist upon referring to this publication by the name of "The London *Journal*." Now, this is not the proper title, which may be seen at the top of every page, and, in its colloquial form of "The Gas "Journal," is, we venture to say, too familiar in the mouths of English-speaking gas engineers all over the world to need the geographical prenomen mistakenly bestowed upon us by some of our American friends. Moreover, there is a *London Journal*, well known to novel-reading young ladies in domestic employment, which is quite as old as, if not older than ourselves; and we are not ambitious to be confused with this respectable publication. We are led to make this protest, which we do in all friendliness, because a slipshod habit of citing the titles of books, newspapers, pamphlets, &c., is a fruitful source of confusion and annoyance. People who allow themselves to fall into this habit are apt to follow it upon occasions when precision is more than ordinarily necessary; and Law Courts and Post Offices do not always make the allowance for mis-descriptions of title which casual readers of many periodicals would perhaps be more ready to understand and condone.

The Engineership of the Beckton Gas-Works is vacant by the resignation of Mr. Frederick Beale, who was appointed to the position when Mr. Trewby took his present office of "Engineer-in-Chief" of The Gaslight and Coke Company.

WATER AND SANITARY AFFAIRS.

SIR THOMAS FARRER, on whose rabid evidence before Sir Matthew White Ridley's Committee, relative to the Metropolitan Water Supply, we commented at the time, has been further distinguishing himself on the same subject, in the course of a speech delivered at the meeting of the County Council last Tuesday. Had the Chairman instead of the Vice-Chairman spoken on the occasion, the utterance would doubtless have been different. Sir T. Farrer has proclaimed Sir John Lubbock as standing in a minority of one with respect to the water question. But, as we have already signified, this may not be quite correct; and even if it were so, it does not prove that Sir Thomas is wiser than Sir John. Neither are we certain how the majority may stand a few months hence. In addressing the Council last week, Sir T. Farrer found himself subject to some disappointment. As Chairman of the Special Committee on Water Supply, he had charge of a report recommending that Sir J. Lubbock should modify the London County Council (Water Supply, &c.) Bill, in the direction of limiting it to the provision of £10,000 for carrying out the "inquiries and negotiations" already authorized by the General Powers Act of last year. But three days after the preparation of this report, Sir John Lubbock received from Her Majesty's Government an intimation which effectually extinguished the Bill for the present session. Consequently, Sir T. Farrer had to tell the County Council that the recommendation of their Water Committee had become "useless and un-"necessary;" and he proposed to withdraw it. Nevertheless, he was able to announce that the Water Committee were proceeding vigorously with their inquiry concerning a new supply. They had £2000 to spend; and when they wanted more, they would acquaint the Council with the fact. How the extra money was to be obtained, Sir T. Farrer did not explain.

Sir J. Lubbock's Bill having thus come to grief, the Vice-Chairman, in the course of his address, turned to the report of Sir Matthew Ridley's Committee. It might have been thought that here he would have found consolation. A report more thoroughly framed in the interests of the County Council could scarcely be conceived. But there was one flaw in it, which was as the fly in the pot of ointment. The report contemplated the purchase of the undertakings of the London Water Companies. This was rank heresy to Sir T. Farrer. He wants the Council to be absolutely free from any proposition of the kind, and to proceed with their inquiries "unhampered" by any such "foregone conclusion." His one great desire is to get hold of a new supply. He is alarmed at the fact that Birmingham has designs on Mid-Wales, where one of the best sources is to be found. We presume that London will proceed to fight Birmingham on this question, unless the coming Council should reject the advice of Sir T. Farrer. If the affair is to be fought out before a Select Committee in Parliament, there will be a further and considerable expenditure of the ratepayers' money. The Council have power to oppose Bills; and, according to present notions, they will put in a plea that London wants the supply which Birmingham proposes to take to itself. "If a new supply is needed, is it to "be a competing supply?" Such is the question asked by Sir T. Farrer, and to which he replies that it is not necessarily so. No person in his senses, he says, would advise competition, "if it can be avoided." Still he considers that circumstances may arise under which competition would be necessary. From the context, it is evident that Sir T. Farrer holds a balance between the cost of competition and the expense of purchase. He is prepared to adopt whichever plan appears to be the cheapest. He "strongly advises" the Council to "keep "this weapon in reserve." That is to say, the Companies are to be brought to their knees by the fear of competition. Another piece of policy espoused by Sir T. Farrer is that if a new supply should be deemed necessary, its cost is to be, "as far as possible," a deduction from what would otherwise be paid as purchase-money to the Water Companies. This shows sufficiently what is the point aimed at throughout. With these conditions laid down, we can quite accept Sir T. Farrer's conclusion, that the Council "are entering on a very long, difficult, and important "business." The one design is still apparent—it is to get possession of the undertakings of the Metropolitan Water

Companies at less than their proper value. The Council are going to give consideration to the remarks of their Vice-Chairman after the recess; and their sittings (after a special meeting to-day) are suspended until Sept. 29.

Some official information, both with regard to the Thames and the Lea, has appeared within the past week. The annual report of the Thames Conservancy shows that something effectual is at last being done concerning the drainage of Staines. The amount of pollution from that town has been diminished; and "there is now reasonable expectation that the remaining pollution will be diverted from the river." It is certainly high time the Staines Local Board were made to provide proper works for the disposal of the sewage of their district; and it seems there is now a fair prospect that this event will come to pass. With respect to those towns where the oLcal Authorities have already laid down sewers and constructed sewage works, it is satisfactory to know that the Conservators are keeping close watch, so as to preclude the possibility of any pollution escaping from such works into the river. Similar vigilance is exercised over house-boats and steam-launches. The value of this surveillance is unquestionable; but it will be noticed that the balance-sheets which accompany the reports of the Conservators show a yearly receipt of £18,000 from the Water Companies. Of this amount, £16,550 has reference to the Upper Navigation—constituting two-thirds of the revenue derived by the Conservators from that part of their jurisdiction. If the Companies may be supposed to diminish the stream, they help to purify and improve it.

The particulars concerning the Lea are of another kind; being contained in a letter addressed to *The Times* by Mr. George Corble, the Clerk of the Lea Conservancy Board, who writes in reply to the communication signed "John Lloyd," on which we commented last week. Mr. Corble very properly describes the epistle which Mr. Lloyd has indited, as "full of inaccurate statements, and calculated to cause unnecessary public alarm." Mr. Lloyd particularized the intake stream of the New River Company between Hertford and Ware as being "turbid and slimy looking" on the 18th ult. Now it happens that the stream had been examined by the Conservators of the Lea on the previous day, as they were executing their annual inspection; and they then found the water, as it passed into the Company's works, to be "beautifully bright and clear." One of Dr. Edward Frankland's reports on the subject is quoted in proof of the excellence of the water distributed by the Company in question. The supply furnished by the East London Company is vindicated by extracts from reports made by Mr. W. C. Young, the Consulting Chemist of the Conservancy Board, and presented to Major Lamorock Flower; being "intended for evidence before the Select Committee on Water Supply who have just reported to the House." As the Select Committee declined to receive evidence with respect to the quality of the London Water Supply, Mr. Young's analyses have been of no avail, except that they are now turned to account in replying to the erratic lucubrations of one "John Lloyd," who wrote to inform the public that the Lea was "played out as a source of water supply for London," and was "now practically pumped dry." Mr. Lloyd may write, and write again; but the Lea "flows on for ever," or, if not for ever, certainly for the present.

Mr. J. Hepworth on the Supply of Gas by Local Authorities.—Last Thursday, a conference of delegates from Local Boards, to the number of about 250, was held in the Westminster Palace Hotel, under the presidency of Mr. R. Gordon Mullen, to discuss questions of general interest to them. Two papers were submitted to the meeting; one being by Mr. J. Hepworth, M. Inst. C.E., Gas and Water Engineer of the Carlisle Corporation, on "Gas Supply in the Hands of Local Authorities." Pending the fuller notice of the paper which we shall give when it is printed, it may be stated that Mr. Hepworth pointed out that at the present time the number of gas undertakings in the hands of local authorities is 30 per cent. of the total, and that the capital invested therein amounts to £21,000,000 sterling. He contended that the low rate of interest at which these authorities can raise capital should place them in an advantageous position with respect to the ownership of gas undertakings; and he thought there was no reason why, if the works were properly managed they should not be carried on with profit to the ratepayers. During the past year about £500,000 of gas profits had been applied to municipal improvements; but Mr. Hepworth expressed the opinion that the local authorities owning gas undertakings should sell gas at cost price.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 224.)

THERE was no improvement whatever during the past week in the position of the Stock Markets in general. The tone was dull and depressed; and business was very limited—tailing off to almost next to nothing towards the close, as the attendance became smaller in view of yesterday's holiday. There were no fresh alarms; indeed what few incidents marked the week, pointed rather in the other direction; but still no show was made of the least step towards restoration of confidence. The Money Market continues very easy; and a light settlement found but small scope for the employment of the superabundance. The Gas Market has, on the whole, been extremely quiet; but there have been several changes in value, and the list is somewhat chequered. First in point of interest as of precedence comes The Gaslight and Coke Company. Their accounts for the half year show a result which is at least no worse than might have been expected. The heavy weight put upon them by the increased charges for coal and labour has been a serious strain; but happily the worst is over, and from this time forth the burden will be lighter. After providing for the fixed charges, the net earnings are sufficient to pay a dividend at the rate of rather more than 7 per cent. per annum, which is about the same rate as that earned in the previous half year. To make up the balance of the 13 per cent. recommended, £160,000 will have to be taken from the reserve fund, which will then be left with only £232,000 standing to its credit. This is the most serious part of the matter. How long will it last, and—what next? However, we have no desire to say more now upon a subject to which we have frequently directed attention, and which will no doubt be discussed at the general meeting on Friday. There were some dealings last Friday in Gaslight "A" at fairly steady figures; but on Saturday the quotation was put 1 lower. The 10 per cents., however, are 2 higher. In South Metropolitans, there was a little business at the old prices; and transactions in Commercials were all marked at about middle price. The only feature in Suburbans and Provincials was a rise of 1 in British. The Continental Companies were strong; and Imperial Continental advanced 3. Continental Unions are now quoted as fully paid stock. Malta was flat, and fell ¼. South Americans were depressed; and a reference to the list will show that all of them suffered a fall in value. Oriental fell another ¼, chiefly owing to some apprehension as to the stability of another undertaking having business relations with it. We understand that all ground for uneasiness is now removed, so the shares may go up again. Water has scarcely been dealt in all the week; but the tone was adverse. The Kent Company meet to-morrow, and divide their usual 10½ per cent.

The daily operations were: Gas opened on Monday unchanged; and quiet business was done mostly in the Metropolitan Companies. British rose 1. Tuesday was unusually inactive; and not one of the Metropolitans was touched. Imperial Continental rose 1; but Bahia fell 1; Monte Video, ½; and Malta, ¼. On Wednesday, there was a little fresh business for the new account, but not much altogether. Buenos Ayres debentures fell 2; and Oriental, ¼. Changes on Thursday were mostly favourable. Gaslight "C," "D," and "E" rose 2; and Imperial Continental, 1; but Pará fell ½. Gas was unchanged on Friday; but East London Water receded 1. Quotations underwent revision on Saturday. Imperial Continental rose 1; but Gaslight "A" and Monte Video fell 1 each; and San Paulo, ½. West Middlesex Water was 2½ lower.

ELECTRIC LIGHTING MEMORANDA.

A New System of Lighting—Professor Crookes at Notting Hill—Electric Lighting under the Concession System—The Electrical Reduction of Phosphorous.

PURELY as a matter of scientific interest, the experiments of Mr. Nikola Tesla upon alternating currents of high frequency, with a view to the production of luminous effects, are of paramount interest just now. "The current of high frequency is produced by the disruptive discharge or accumulated energy of a condenser maintained by continuously charging the condenser and discharging it disruptively, in connection with an induction coil which generates the high potentials required." We are not very clear upon this subject; and a professional electrician would probably be somewhat exercised if required to give a popular explanation of Mr. Tesla's method of producing his high-potential alternating current of enormous frequency. At any rate, a current of this character is experimentally producible; and its effects are certainly astounding. Lamps are caused to glow without actual connection with the source of electricity; and the ordinary brush discharges from electrified points *in vacuo* assume, under these conditions, the appearance of a real flame, hardly distinguishable (save in respect that it is not combustion) from a flame of illuminating gas. Our contemporary the *Electrical Review* calls Mr. Tesla's communication of these astonishing

experiments "epoch-making;" and, although the term is very frequently abused, it must be regarded as justified in the present application. For it would appear that, for the first time in modern experience, a form of energy derived from mechanical movement has been so speeded up as to radiate luminously. Mr. Tesla's experiments are thus a commentary upon Dr. Oliver Lodge's remarks relative to the desirability of the direct production of light by mechanical means. The mechanical equivalent of light is admittedly small; but hitherto the difficulty has been in intensifying radiations to the necessary pitch where luminosity begins, without first passing through all the long range of non-luminous heat radiation. This is what Mr. Tesla seems to have done, if we interpret the principle of his researches aright; and it is impossible to exaggerate the interest of experimental work of this order.

Not long ago Professor W. Crookes formally inaugurated the first central station of the Notting Hill Electric Lighting Company, of which he is Chairman, by calling the principal residents of the neighbourhood together, and delivering a popular lecture on the general advantages of electric lighting, and the special benefits likely to be enjoyed by the supporters of this particular concern. The little "social function" was very successful, as it could hardly fail to be, with one of the first chemists and natural philosophers of the day unbending in this entertaining manner. The whole thing was, of course, meant for an advertisement. But there is no harm in this fact; for electric lighting undertakings must recommend themselves to public notice like other commercial ventures, if they are not to be overlooked. We observe with some regret, however, that Professor Crookes allowed himself on this most interesting occasion to repeat, for the sake of advertisement, an experiment which he must recognize as a piece of claptrap. We refer to the well-known trick of demonstrating the safety of electric lighting in a house by wrapping an incandescent lamp in a cambric handkerchief and breaking the bulb, when of course, the filament instantly consumes without igniting the fabric. This pretty little demonstration is as meaningless as it is cheap, and, in a sense, effective. In point of fact, however, it is calculated to do more harm than good, by diverting the thought of the consumer from the real danger of faulty wire connections to the false one of the lamp itself. Naturally, seeing that with the more familiar gas or candles the immediate danger from fire proceeds from the source of light, the uninstructed observer of electric lighting by incandescent lamps would imagine that these might be dangerous in the same way. While disabusing his mind of this idea, however, it is unfair to allow the user of incandescent electric lamps to go to the other extreme of confiding in this method of lighting as being perfectly safe, and thus possibly running into danger simply through not knowing where to look for it. A low-potential current is as capable of burning down a house as a current of high potential or a misdirected gas-flame; and while a householder can promote this result of a supply of electricity from Professor Crookes's Company by the heedless driving of a nail, it is highly desirable that he should not be lulled by the handkerchief and lamp trick into a mistaken sense of safety.

The admiration of a writer in the *Century* magazine for everything Parisian was commented upon in last week's JOURNAL with reference to the gas supply. The writer deals in the same spirit with the electric lighting of Paris; maintaining with infinite enthusiasm that the treatment of this branch of the public service by the Municipality is, like everything else that is Parisian, perfectly wise and grand and scientific, and in every way admirable. This does not prevent the price of incandescent lighting in Paris from being half as dear again as it is in London, and twice the average American rate. But such a consideration is, of course, immaterial. All over the Continent the concession system has taken hold of electric lighting as firmly as it has of gas, with the result that the contractors are bound to put up the selling price to private consumers in order to make themselves secure. The insatiable rapacity of Continental municipalities is a very wonderful trait of their character, and has been developed very largely by the prevalence of indirect taxation in the same part of the world. The Continental municipality, in taxing everything it can lay hold of, only copies the method of the national government, which does the same thing upon a larger scale. The advent of a new industry, such as that of electric lighting, is a godsend to many a half-starved municipal body on the Continent; but how the industry is to flourish there under its heavy fiscal burdens, when it does so badly in the United Kingdom, is a puzzle to the careful observer.

The possibility that the cost of manufacturing matches will be reduced by the application of electricity to the production of phosphorus from mineral sources, is one of those surprises of modern industry that strike the observer with all the force of a paradox. It is a point with electricians devoted to lighting, that they can enable users of their system to dispense with the matches which to users of gas, oil, and candles are indispensable. We do not remember to have seen the saving of matches employed as an argument for the superior economy of electric lighting as compared with all lights of combustion; but it is doubtless taken into account by the electrical apologists. Hence it is all the more striking that matches should be yet further cheapened by an industrial application of electricity. Phosphorus, however, has other uses than that of striking a light; and the way in which electricity is applied in its reduction from the minerals containing it, is a triumph of modern industry. Briefly, the process is similar to that of the Cowles Company for the extraction of aluminium. A powerful current is conveyed by carbon electrodes into the raw materials, which are packed into a kind of furnace. The phosphorus is thus volatilized and driven off to condensers, whence it is afterwards collected.

A NEW TRADES UNION DEVELOPMENT.

PERHAPS it will not be a very extravagant assumption for us to make, if we observe that most of our readers are probably more or less familiar with the interesting matters dealt with in Mr. Bellamy's decidedly clever book, "Looking Backward." This work is no more than an ordinarily rapid reader could comfortably get through in the course of a railway journey from London to Manchester; and, however strongly he might be predisposed against Socialism, the reader who is sufficiently interested in it to peruse the book to the end, will rise from the task quite prepared to admit that "there is something in it." With this, however, the vast majority of English readers of Mr. Bellamy will stop. He may interest and amuse us, even to the extent of leading a few to compare things that are, to their disadvantage, with things as Mr. Bellamy would have them to be; but we do not take our author seriously. He is better than the ordinary run of writers of "shockers," perhaps; and the man who has passed the time on a trip to Manchester reading Bellamy is apt to look down on the other man who has been wrapped up in the last Farjeon curdler. But the feeling does not last. This being the prevailing sentiment in a reading community where Bellamy sells, but does not govern, it is with something of amazement that we learn how, in the United States, this same author has become the founder of a creed. Astonishing as the information may be, the fact remains that the author of "Looking Backward" has been on this very account accepted as a prophet of very respectable dimensions by a considerable number of his compatriots, and has become the founder of a party in the community known as Nationalists, who are committed to the endeavour to bring about a kind of Municipal Socialism by applying political power in this direction. These Bellamy Socialists differ radically from the Social Democrats we have in England, and the Communists and Nihilists known to Continental politicians, inasmuch as there is nothing violent in their views or methods. They aim at consummating their economical revolution by the use of strictly constitutional means. The United States furnish ground and scope for a variety of strange socialistic experiments; and the land that fostered Joseph Smith may well support half-a-dozen Bellamys without reproach. Rashness in accepting latter-day prophets upon their own valuation is an amiable weakness of the Yankee, notwithstanding all his reputed shrewdness; and we are quite ready to concede that the Nationalists are a distinct improvement upon the Oneida Community; and even that State Socialism, as they understand it, is the most hopeful kind of Socialism yet put in circulation in any part of the world.

We hear our readers exclaiming: "Supposing that Nationalism is all this, what has it to do with the gas industry?" The connection is soon demonstrated. It is the principle of Mr. Bellamy's few valid claims to originality, that he showed how individual effort might be converted into public duty through the intermediate course of joint-stock enterprise. All other socialistic writers have deemed it necessary to begin their constructional work by creating a new heaven and a new earth; all old social systems being put out of the way in order that their imaginings might have free scope. This was very convenient for them, but hard upon their readers, who saw no means of reaching the Utopias held up for their admiration. Even such a matter-of-fact visionary as Dr. B. W. Richardson omitted to give the latitude and longitude of his Hygeia, or City of Health, and left the date of its foundation altogether blank in the record. Mr. Bellamy avoided this error; and he set up joint-stock monopolies generally in a new aspect as the needed "missing-link" through which individual endeavours may be converted into socialistic duty. The notion is clever, and the suggestion not by any means despicable. Convert the basis of a trading company into a co-operation, and sink the capital, and the result is something so nearly like socialism as to be barely distinguishable from it.

One argument is necessary to help forward the conversion of private trading into joint-stock enterprise, and thence into a co-operative monoply—the proof that the alteration is for the benefit of the community. Mr. Bellamy supplies this proof by showing that concentration saves expenses and wastefulness of operation in many ways; so that where a co-operative undertaking is fairly started, and managed with ordinary intelligence, the small retailers' competition must necessarily fail after awhile. The result is a perfectly natural consequence of the operating conditions. But where can one find a better illustration of the advantages of concentration in an industrial undertaking than the case of a statutory gas company? In this example, the work that half-a-dozen rivals could only do badly, and at exorbitant cost, is done cheaply and efficiently by one concern, in which, moreover, the force of Individualism is curbed by reference to the concurrent interest of the community.

A perception of this truth is slowly dawning upon the people of the United States through the working of this new spirit of so-called Nationalism of which Mr. Bellamy is the acknow-

ledged creator. Strange as it may appear, there is reason for thinking that the folly and shortsightedness which have left the town populations of the States helpless before the machinations of "gas pirates" are giving way at last before the light, such as it is, of Nationalism. And it is easy to see how this result is being brought about. The "gas pirates" have had up to the present time unquestioned command of a most powerful weapon of attack—the argument in favour of unrestricted competition in trade. This argument has been convincing with very many raw communities, the members of which have been unable to see any distinction between the industry (say) of bread making and that of gas supply, so far as the operation of a monopoly was concerned in each case. They naturally looked with suspicion upon the defenders of a gas undertaking when these latter used such a plea as the statement that, while competition is good for some trades, it is injurious to theirs. What Nationalism has done in this connection is to exhibit the truth that competion in all trades is only a means to an end, and that in many circumstances—of which gas supply is an illustration—it may be advantageously exchanged for other safeguards against the abuse of Individualism.

It is therefore a sign of the working of a new spirit in the land when we observe Taxpayers' Associations on the one hand and University classes on the other, throughout the length and breadth of America, studying the problem of the relationship of public authorities to *quasi*-public works, such as gas undertakings. Moreover, we are informed, upon credible authority, that the Trades Unions and Workmen's Societies of various denominations in the United States are at length becoming awake to the essential futility of restricting their solicitude to questions of work and wages, and are turning the attention of their members, as taxpayers and citizens, to the same more important, if less obvious, questions of public administration. What may be the upshot of this movement it is of course impossible to say; but when the Trades Unions of this country are found discussing the question whether gas supply ought to be in public or private hands, and, if the former, the principles that should be observed in its management, we shall be inclined to think more highly of the intelligence of their leaders than we do at present. We hope we are not unduly magnifying the force of the new movement that is evidently breaking here and there through the tame surface of the American social drift, which is at the same time bearing M'Kinleyism and other more obvious *flotsam* towards the dim Future. But that more is going on in those regions than meets the eye of the casual observer, cannot be denied. Recently we had occasion to notice the fact that the authorities of the Toronto University have taken it upon themselves to offer instruction to the people in respect of such matters of public interest as the regulation of gas supply, &c., which are generally left to the interested handling of partisans. The other day, we observe, a paper on the "Municipal Ownership of *Quasi*-Public Works" was read by Mr. Allen R. Foote before the Baltimore Taxpayers' Association, which was so much to the point that our contemporary the *American Gaslight Journal* reprinted it at length. We cannot do likewise now; but the following paragraph will show the bearing of this striking composition upon the gas industry. Addressing the ordinary voter, Mr. Foote says: "In dealing with gas companies, you have sought to gain an economic advantage by issuing franchises to different companies, in the ignoble hope that they would be for ever fighting, and thus give you a chance to fatten on their blood. Your experience, and the present condition of the gas industry in your city, render comment unnecessary to make clear your absolute failure to gain an economic advantage in that way." When such language as this can be used by an impartial person in the hearing of American citizens, it is almost possible to hope that even British ratepayers who make "profits" out of their gas undertakings may some day listen to reason. Mr. Foote is no believer in this kind of fallacy. He goes so far as to declare that, in his judgment, "there is not a Municipality in the world, owning and operating *quasi*-public works, that has gained an economic advantage by means of such ownership." This is a hard saying; and we are not at present concerned either to define or defend it. All the same, we should much like to hear of somebody like Mr. Foote coming out of the Victoria University and lecturing the Manchester burgesses in the same strain in the Free Trade Hall. There is also a University College at Nottingham; and there is just as much fondness for indirect taxation in the Nottingham Town Council as there is in Manchester.

We notice these things among the signs of the times. Gas supply is not about to pass away among the things that were; but its emoluments and its responsibilities are going to remain for the benefit, or perplexity, as the case may be, of future generations. This being so, we should like the new spirit that seems to be moving among the "machines" of American municipal politics, to manifest itself in some acceptable shape over here, and stir the dry bones of our respectable corporations. We are too solid to be moved by a Bellamy; but we can move to the purpose when the right hand touches the springs. Just at present, however, municipal and even national politics, like trade, are very quiescent; and it is not at all likely that the revival of Trade Unionism, which, having been largely instrumental in producing the Labour Commission, seems dying under investigation, will retain sufficient energy to copy the American example in opening up new issues in our municipalities.

NOTES.

Solid Particles in Flames.

At a recent meeting of the Royal Society of Edinburgh, Professor Tait communicated a paper by Professor Stokes upon an optical proof of the existence of solid particles of matter in luminous flames—the Davy hypothesis which has been re-discussed of late by Professor Lewes and others. Professor Stokes's method consists in condensing sunlight on the flame to be observed. The light is scattered by the solid particles in an extremely thin layer both where the beam enters the flame and where it leaves it. It is polarized in the plane of reflection. The effect is not found in some flames which appear to be luminous, or *quasi*-luminous, like a Bunsen flame tinged with sodium. This observation seems to show that in this case the sodium is present in the form of vapour, not in solid particles, which has been suspected from other indications. Professor Stokes's method recalls in principle the experiments of Soret in 1874, mentioned in the first of Professor Lewes's Cantor Lectures to the Society of Arts, on "Gaseous Illuminants."

A Reliable Pyrometer.

It appears from a paper by Mr. H. L. Callender, published in the *Philosophical Magazine*, that at last something like precision has been secured in a thermometer for high temperatures. This much-needed instrument is made by Mr. Callender in the form of a platinum resistance, the simplest shape of which consists of a coil of fine wire welded to leads of comparatively low resistance. The electrical resistance of such a wire varies according to its temperature; so that the reading of the one gives the other by consulting a table prepared with reference to the zero of the instrument. The well-known Siemens electrical pyrometer depends upon the same principle; but in this case the zero is known to change largely and continuously. Mr. Callender, however, indicates that this effect is due to the imperfect design of the Siemens instruments; and he declares that if the wire is pure to start with, and is protected while in use from strain and from contamination, its resistance, after having once been annealed, is always very near the same at the same temperature. Mr. Callender's improvements in the platinum resistance thermometer, or pyrometer, seem therefore to consist in the better protection and treatment of the platinum wire. This is differently treated according to the heats to which it is to be exposed. For use at temperatures below 700° C., the leads may be of copper or silver, and the tube of hard glass. For rough work at temperatures below 1000° C., very fair results may be obtained by the use of a wrought-iron tube. The instrument is the size of an ordinary thermometer.

Hints on Riveting.

Mr. Le Van (*Journal of the Franklin Institute*) remarks that there are four descriptions of riveting in use for strong plates: (1) Hammered or hand riveting; (2) snapped or set; (3) countersunk; (4) machine. Of these, machine riveting, in which the rivet is pressed into its ultimate shape without a blow, and by a continuous, controllable compression, is the best for producing a good sound job. Snapped riveting (such as is generally used for gasholders and other structures) is next in quality to the work of the hydraulic machine. Countersunk riveting is generally tighter than snapped work; because countersinking the hole is really facing it, and the countersunk rivet is in point of fact made on a face joint. But countersinking the hole also weakens the plate; and it should only be resorted to where necessary to preserve a flush surface. Hammered riveting, such as is used for boiler work, is much more expensive than either machine or snapped riveting, and has a tendency to crystallize the iron in the rivets, causing them to become brittle. Machine riveting is the only class of work which takes the fullest advantage of the plastic condition of the hot rivets; making the metal flow into every crevice of the rivet-hole, and thus fulfilling one of the prime conditions of good riveting. In order to ascertain the relative advantages of pressed and hammered rivets, two plates were riveted together; the holes being purposely left a little out of line. These plates were then planed through the centre of the rivets, so as to expose a section both of the plates and the rivets. It was observed that the machine-driven rivet filled the hole completely; while the hand-hammered rivet did so very imperfectly. This experiment was tried several times, with similar results on each occasion. Mr. Le Van estimates the superiority, in favour of the riveting-machine over hand riveting, as at least 10 to 1.

The Hall Gas Process.—A new gas generator has been invented by Mr. Thurston G. Hall, which manufactures gas from cheap slack coal into which crude Lima oil is sprayed with a steam-jet. As described by the inventor, a smouldering fire only is maintained, and the mixture of smoke, oil, and steam is forced by a fan into a chamber filled with electrodes, which generate electricity at a temperature of 600° Fahr. and upward. The inventor states that the electricity decomposes the steam, oil, and smoke, from which a fixed gas results. The Company who are making the generator claim to be able to produce more than a million cubic feet of gas from a ton of coal at a cost of not over 2½ c. per 1000 cubic feet. They have contracted to furnish a company in Illinois with illuminating gas at 15 c. per 1000 feet. Fuel gas is generated by using a smaller quantity of oil.

COMMUNICATED ARTICLE.

LUMINOUS AND NON-LUMINOUS COMBUSTION.

FIFTH ARTICLE.*

By B. H. Thwaite.

It has already been shown, by analytic equations, that the most perfectly scientific, and consequently efficient, method of combustion for lighting purposes is the recuperative incandescent one. In this the combustion *per se* is non-luminous—the whole of the combustible elements being practically oxidized together; the heat resulting being partially imparted to a foreign substance inserted in the zone of combustion, and partially transferred in sensible form to the products of oxidation. This sensible heat is to a considerable extent restored by the air flowing to support combustion. If, instead of air, pure oxygen were supplied, the action of combustion would be still more complete, and would then be perfectly idealistic, because the action of oxidation would not be retarded, and would be more condensed, as the inert nitrogen would not intervene between the atoms of attraction.

The Cause of Non-Luminosity of Combustion.

The truth of the suggested explanation of this nature of combustion—that it is due to the practically simultaneous oxidation of the hydrogen and carbon constituents—is self-evident, and is the opinion of foreign physicists who have given a lengthened study to flame phenomenon. It has lately been asserted that the cause of the non-luminosity of a Bunsen flame is due to the cooling influence of the nitrogen. Although there may be an inconsiderable lowering of the temperature of combustion due to the intimate, and enclosed, intermixture of this inert gas, the following reasons may be advanced, showing that this "cooling influence" theory is untenable:—

1. The temperature of oxidation of carbon, or that necessary to effect chemical combination, is decidedly an incandescent one, visually measured; and unless this temperature were attained, involving the production of luminous energy, oxidation could not take place.

2. The introduction of foreign atomized refractory substances into a non-luminous flame will convert the latter into an intensely luminous one; showing that the temperature is sufficient to raise the atoms of carbon to an incandescent condition. Of course, the temperature of a non-luminous flame at one point in the zone of combustion is higher than that of a luminous one, because the carbon is also oxidized in practically the same zone as the hydrogen, and there is thus available the thermic value due to this second action.

3. If oxygen is introduced in perfect admixture with the combustible gas, a more perfectly non-luminous character of combustion may be obtained. Instance the oxy-coal-gas lime-light employed for lantern purposes, which owes its brilliant luminosity to the incandescence of the lime.

4. It has been suggested that the effect of the introduction of chlorine to the base of a Bunsen burner gives illustrative and confirmatory evidence in favour of the cooling theory. There is absolutely no parallel. By a thermic analysis, we find that the oxidation of 1 grain of H to gaseous H_2O—thus: $\frac{H_2 + O = H_2O}{2}$ — gives 29,300 calories; and this measure of heat is almost entirely transferred to the liberated carbon atoms. The introduction of chlorine instead of air or oxygen involves a lowering of the thermic result. Instead of 29,300 calories being produced, the chlorination of the hydrogen ($H + Cl = H\,Cl$) gives a thermic value of 22,000 calories only; the absence of air or oxygen and the lowering of the temperature bringing down the carbon in a finely divided condition as soot. The prior application of heat to the nitrogen or the air supplied to a Bunsen burner may partially restore the luminous quality of combustion, because the application of heat involves, by the law of Charles, a volumetric expansion, or every degree centigrade added to a gas increases its volume by the fraction of 1·273rd = 0·003665. Therefore, by this expansion, the same volume of air cannot enter the Bunsen burner; and the carbon is therefore *minus* its equivalent proportion of oxygen. Consequently, it is emitted from the burner in an incandescent condition, to be oxidized in the usual way. So that we may say that the non-luminous combustion is not primarily attributable to the cooling influence of nitrogen. *Q.E.D.*

The Oxidizing Value of Non-Luminous Combustion.

The more perfect the non-luminosity of a flame, the more it is reliable as an oxidizing agent. Where there is a luminous nature of combustion, the presence of unoxidized carbon atoms is an obstacle to regularity of oxidizing action. The importance of this non-luminous quality in industrial operations has not been fully realized; it involves, of course, pre-admixture of the air and gas. By this means the author has succeeded in oxidizing in four hours 4 per cent. of carbon iron down to 0·85 per cent. carbon iron (steel), without any solid oxygen addition. This powerful oxidizing action of practically non-luminous combustion is pregnant with importance in industrial operations.

* The preceding articles will be found in Vol. LVI., p. 1238; and Vol. LVII., pp. 154, 446, 742.

Luminous Combustion.

It may be proposed as an axiom, that luminous combustion, derivable from the oxidation of hydrocarbons, can only be produced by the pre-oxidation of a combustible element other than that emitting the light of incandescence. Therefore the oxidation of carbon *per se* gives a non-luminous flame—

$$C + O_2 = CO_2.$$

The same may be said of the oxidation of CO—

$$CO + O = CO_2.$$

The oxidation of methane (CH_4) gives a flame of certain luminous value; the action proceeding in the following sequence:—

(1) $H_4C + 2ON_4 = 2H_2O + C + 2N_4$.

Interval of periodic incandescence of carbon.

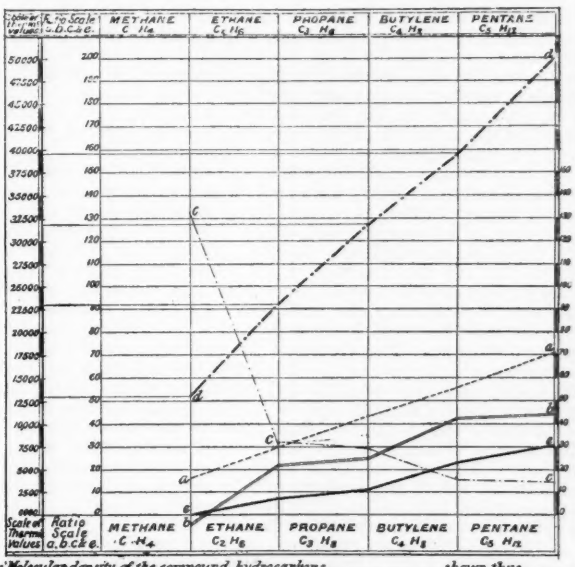
(2) $C + 2ON_4 = CO_2 + 2N_4$.

The proportion of carbon to the hydrogen is small. Hence the molecular density of methane is too low to produce a high luminous degree.

The following may be accepted as a truism and a law: The greater the molecular concentration or density of the constitution of a given hydrocarbon, the greater the degree of luminous efficiency. The truth of this suggested law is abundantly confirmed by the following table, and graphic diagram prepared by the author.

Table showing the Effect on Thermo-Luminous Action of Increased Molecular Density of Hydrocarbons.

Character of hydrocarbon	Methane	Ethane	Propane	Butylene	Pentane
Chemical constitution	CH_4	C_2H_6	C_3H_8	C_4H_8	C_5H_{12}
Molecular density	16	30	44	56	72
Thermic value in terms of calories per gramme without reduction (calculated)	13,310	12,264	11,770	11,067	11,190
Ratio of density to photometric value	0·0062	0·0233	0·0250	0·0430	0·044
Thermic value due to increased density	13,310	22,995	32,367	38,734	50,386
Calories absorbed per unit of photometric value	13,310	5,285	2,997	1,576	1,574
Luminous or photometric value, methane being taken to equal 1 candle	1·0	0·7	10·8	24·6	32·0



a. Molecular density of the compound hydrocarbons ..... shown thus .....
b. Ratio of density to photometric value ..... " "
c. Ratio of thermo-luminous efficiency in calories absorbed per candle power ..... " "
d. Ratio of increased thermic value due to increased density ..... " "
e. Ratio of increased photometric value ..... " "

This law harmonizes with the effect of concentration or condensation of all forms of energy. A practical example may be culled from electro-practice: A regulator arc light fed by a current the constants of which equal 25 ampères and 35 volts, absorbs energy equal to 1·20 horse power (French) for the production of a luminous energy of 200 Carcels; whilst an incandescent lamp usually absorbs for a luminous power of 2 Carcels some 5 kilos. of energy. It follows, therefore, that with this divided and less concentrated effect, an equivalent luminous production of 200 Carcels would involve the expenditure of 500 kilos.—say, 7-horse power (French); or with a 100 per cent. distribution of energy, or reduced concentration, there is required some 500 per cent. more power to produce the same luminous energy.

We all know that the thermo-luminous efficiency of the system of lighting by incandescent electric lamps is greatly inferior to the light obtained from coal gas. That this will ever be so is an incontrovertible fact. (*Vide* "The Rationale of the Principle of Recuperation in its Application to Gas-Burners," in the JOURNAL in 1886.) But when the ordinary light of coal gas is compared with that of the electric arc light, the thermo-luminous efficiency is greatest in the latter system.

The diagram is very interesting. It shows in a salient manner the side-by-side increase of the thermo-luminous efficiency with that of the molecular density of hydrocarbons; the gradations of increase being singularly regular. It further shows, and most

conspicuously, that as the density increases, the thermo-luminous efficiency becomes greater. The photometric efficiency of still higher hydrocarbons—naphthalene, for instance—can be approximately ascertained by the development of the graphic diagram. Measured in this manner, it gives the unit of photometric value of naphthalene to be equal to from 65 to 70, or 325 to 350 candle power per 5 cubic feet per hour.

TECHNICAL RECORD.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

The Annual Meeting in Edinburgh.

In the JOURNAL last week we gave a general report of the proceedings at the above meeting, with the text of the paper read by Mr. G. R. Hislop, of Paisley, on "A New Form of Gas-Burner Specially Adapted for Gas-Testing Purposes," and a report of the remarks which it elicited. To-day we commence the publication of the remaining papers, with the discussions thereon.

Mr. JOHN WEST (Manchester) submitted the following paper, of which copies had been distributed to the members. He merely read extracts therefrom:—

LABOUR-SAVING APPLIANCES FOR GAS-WORKS.

Gentlemen,—My first duty is to thank you for the honour your Council has conferred upon me by inviting me to read a paper before this Association upon the adaptability of machinery for various sized gas-works. I believe this invitation was the outcome of a visit of inspection made by your Committee of Investigation to the Aberdeen Gas-Works, where my cannel breakers and the rope-power system of charging and drawing machinery have been in satisfactory operation for about eight months. The vital importance of this subject is being acknowledged by the great majority of engineers. All modern gas-works are being arranged for the introduction of machinery for carrying on the various operations, with a view to the economy of labour; and inasmuch as the subject I am dealing with embraces that department in a gas manufactory in which the greatest number of men are employed at the highest rate of pay, on account of the arduous nature of the work, it has received the attention of gas engineers from the earliest years of the industry.

It may be interesting for you to know that my first experiments in machine stoking were made with a retort open at both ends; the mouthpiece at one end being sufficiently long to hold a charger, which was supplied with coal from a hopper fixed on the top of the mouthpieces—the charger-rod passing through a stuffing-box in the mouthpiece lid. The front end of the charger was provided with a moveable plate, which performed the service of pushing the coke forward into the chamber at the far end; the coal being deposited while the charger was being withdrawn. The results of the preliminary experiments induced me in the year 1873 to take out a patent for this method of stoking; but after a lengthened experience, when working on a practical scale, and a careful testing and consideration of its advantages and disadvantages, I came to the conclusion that the results obtained would not warrant an extension of the system.* The advantages of mechanism for distributing the coal in the retort and pushing out the coke were, however, so apparent that I turned my attention to securing them by avoiding the drawbacks of my first methods.

I then decided to put up a bench of short retorts in the ordinary way, except that I had a mouthpiece at each end; the one at the farther end of the retort being for the removal of the coke. Then I devised a travelling trolly running upon rails in front of the retorts; and within the framework of the trolly was contained a hopper for carrying the coal, as also the charger for pushing out the coke and distributing an even layer of coal in the retort. This scheme, after a long experience of its working, appeared a success. As far as the mechanical arrangements were concerned, it undoubtedly was so, and several of my engineering friends advised me to erect larger retorts upon a more extended scale. In consequence of this advice, I had erected two beds of seven ⌂ retorts, each 21 in. by 15 in. by 11 ft. long; and to ensure the perfect arrangement of these settings, a London engineer kindly lent me his foreman and another retort-setter to erect them. Attached to these beds were a separate condenser, exauster, purifier, meter, and gasholder, with the most modern apparatus for testing purposes.

In addition to a new travelling trolly with a combined charging and discharging machine, I now used for the first time coal breaking and elevating machinery to supply the charging apparatus. The machinery worked in a most satisfactory manner; but to our surprise we could not get the retorts hot enough to burn off as much coal as we anticipated and had a right to expect. After consideration, we came to the conclusion that the setting was defective, and we tried to improve it. But we still failed to get sufficient heat; so we pulled out the retorts, and rebuilt them upon the same plan as other settings which were giving good results on the old system, and started to work again. To our utter astonishment, we had no better results as regards the heating of the retorts, especially for 2 feet from the outlet end. I pointed this out to many of my friends, but they could only suggest again that the retort-setters must be at fault. From further observations I was induced to believe that I had discovered the cause. I therefore decided to block up the retorts with 14 inches of brickwork; and I was very glad to find that my surmises were correct. In a few hours the increase of heat became pronounced; and in the course of a few days I obtained excellent returns, and commenced to get better results than I had ever been able to produce, or had heard of, as regards make per ton, illuminating power, and saving in labour. This I attributed to retaining in the setting the heat previously sacrificed or lost by radiation through the additional mouthpiece for the exit of the coke (to which I shall refer later on), to the breaking and elevating of the coal, and the even distribution thereof in the retort. I had also diminished the arduous labour of the stoker, prevented the necessity of his working so close to the retort, and provided him with a screen from the fierce heat; leaving him nothing to do but simply turn a handle to fill the charger, then run it in, turn the scoops over, and withdraw it from the retorts. This, gentlemen, is how my manual machinery was first brought out. The increase in volume and illuminating power, with the economy that resulted in its working, realized my utmost expectations; and the fact of its being so simple, with few working parts, and consequently very little wear and tear, has no doubt been the cause of its great success.

Upon the results of experiments made by the late Mr. F. W. Hartley and others, the Maidstone Gas Company decided to apply the system to their works as fast as the old ovens were worn out. Their lead was soon followed by Richmond, Portsmouth, Ipswich, and others; and at the present time we have supplied 21 gas-works with manual machinery (this is exclusive of those supplied with power machinery) having had duplicate orders from four, triplicate orders from two, and quadruplicate orders from one of the above gas-works.

Before going into the question of cost and saving, allow me to give you a short description of the apparatus as it now is. I found that, in order to make the machinery work successfully, it was necessary to have the coal of uniform size, and conveyed from the coal-stores into the charging scoop at a minimum cost. To accomplish this, I designed a coal-breaker, elevator, and conveyors to carry the broken coal into the retort-house; and I provided fixed store hoppers in such a position that the machines travelled under them. By having an adjustable hopper in the charging-machine, capable of carrying sufficient coal for a dozen or more charges, with a frame attached for carrying the charger, the item for coal trimming and coal wheeling was reduced to an exceedingly low figure. It is an advantage, in designing new retort-houses, to erect coal-stores on each side of the retort-house; and, if possible, provision should be made for an overhead railway running through them, so that the coal can be tipped direct from the truck into the coal breaker by opening the doors at the sides or bottom, or by lifting the waggon up by the buffers at one end, and letting the coal run out at the other, as in the case of the Oldham arrangement. Mr. E. Baker, of Reading, designed a somewhat similar arrangement for his retort-house in connection with my machinery.

The position of the coal-stores in relation to the retort-house in works already erected, is no bar whatever to the application of machinery, for the comparative saving in labour is greater in those works where the stores are separated and at a distance from the retort-house, by using a system of conveyors, as illustrated in the case of Folkestone, Belfast, Cheltenham, Sheffield, Birmingham, &c.; thus dispensing altogether with the serious item of coal wheeling. Indeed, it is in this direction that a great portion of the saving is effected—a fact which I recognized when first attempting to deal with the question of labour-saving appliances in the retort-house.

This machinery has been found most suitable for small and moderate-sized retort-houses, and is known as the manual charging and drawing machines. These machines have, I believe, been brought to a state as near perfection as they can be, if we may judge from the fact that they have undergone very little alteration during the past few years, and have given universal satisfaction wherever they have been installed. As is well known, they depend more on the strength of the stoker than do the other classes of machinery; but the skill required to work them is even less than with the power machines, as there are only a few simple movements to be made, and less mechanism to look after. The charger I use with these machines deposits in the retort the most perfect layer of coals that it is possible to imagine, and renders bad charging by unskilled men quite out of the range of possibility. Indeed, an expert man is far more likely to charge badly than a novice, because he learns tricks to save time by not letting the charger run its full course, or by turning the scoops over before the proper time. The saving in the cost of labour by these manual machines is such as to justify me in urging their universal adoption in all gas-works where there are not sufficient retorts to employ economically the more costly power machines. I scarcely think it necessary to describe the methods of operation of these machines, as the models and photographs before you will illustrate them better than pages of description.

* An illustrated description of the arrangement here referred to appeared in the JOURNAL for April 17, 1889 (pp. 692-3).

The next step in the development of the present power machine was the addition of the necessary parts for working the manual machine by compressed air. The machines first made were but little different to the manual kind; but additional strength was found necessary, and was added, step by step, as the power was increased, until the compressed air machines differ but little from those driven by other powers. The transmission of power by compressed air has many excellencies to recommend it. The first machinery of this kind was erected at the Rochdale Road works of the Manchester Corporation in 1881, and is still doing good work on a large number of retorts. The compressed air is delivered to the machines from a fixed hose-reel by flexible hose. Many sets of this kind of machinery are working—including Manchester, South Metropolitan (Old Kent Road), Crystal Palace, Whitwood, and Sydney (N.S.W.); and compressed air plants of a still more advanced form are working at Birmingham, Beckton, and Belfast. In the latter kind of machines the charging is done by a long scoop similar to that in use on the rope-driven machines, which does not rest upon any part of the retort, and delivers a larger quantity of coals than can be done by the charger of the manual type. These long scoops necessitated a longer hopper to feed them, and more power to work them; and the additional weight to be propelled overpowered the hand method in use until then, and rendered it imperative to add mechanical means.

The first two sets of the rope-driven machines were erected, according to the instructions of Mr. S. R. Ogden, for the Blackburn Corporation. The house is on the ground floor, with large coal-stores on each side under the same roof as the retort-house, but separated from the working space by columns supporting the roof. There are 34 benches of retorts, making 340 mouthpieces; and the retorts are not throughs. The mouthpieces are of the same section as the retorts, and are 20 in. by 15 in. ⏛. One drawing-machine and one charging-machine on each side of the house works the whole of these retorts, with the exception of a bed at either end, which is too near the wall to allow the machines to work. The coal is delivered to four coal breakers—two on each side of the house—by carts, and the coke is drawn out of the retorts directly into barrows placed in front of the drawing-machine, and between it and the retort-stack. A small steam-engine is placed in a room built off one corner of the coal-store, and a line of shafting is fixed at right angles to the stack, with rope pulleys for driving the rope. The latter extends the whole length of the house, without any support for the bottom or driving strand, except the machines, which may be anywhere between the two ends.

Another example of the rope-driven system is that now working at the Beckton station of The Gaslight and Coke Company, where it is erected in the No. 12 retort-house, in which there are 45 beds of nine through ⏛ retorts, of 20 in. by 13 in. section, or a total of 810 mouthpieces. The house is of the standard Beckton type, with stage-floor and generator furnaces. The coal-stores are at either side, and are separated from the house by the roof columns only; the coal being brought in by an overhead railway on each side, and the coke falling from the retorts to the basement, from which it is removed in railway trucks. There are six charging and six drawing machines provided, two of each being kept as duplicates and in reserve in case of fogs, or any other exceptional demand for gas requiring four-hour charges to be put in to meet it. The engines for driving the ropes are fixed at one end of the retort-house, under the stokers' lobby; and two are provided—one being always out of action. Between the engines, and on the same centres as the respective crank-shafts, there lies a length of shafting with clutches at each end, by which either engine can be coupled up to the work. On this length of shafting are fixed the six pulleys for driving six sets of overhead countershafting by belts. Each set of countershafts, of which there are three on each side of the stack, drives the rope which communicates power to one pair of machines, and stretches the whole length of the house, with two or more intermediate supports, according to the position of the various machines. Each pair of machines—one drawing and one charging machine forming a pair—is kept quite separate and distinct from the remainder of the plant; and any pair can be left out of action or put into action at will. Either pair can work in any position on the one side of the house, and draw any of the retorts. The coal is dealt with by four coal-breakers (with elevators and hoppers) on each side of the house; and when loaded from the ship into waggons on the pier, it needs no further handling until the coke is shovelled into the trucks which remove it from the basement of the retort-house. The loaded coal-trucks pass over the coal-breakers in the coal-store, and deposit the coal on the breaker. It is then elevated into the storeage hoppers, passes from there into the charging-machine, and is delivered into the retort. When it is carbonized, the coke is drawn out, and falls into the basement direct—no handling whatever being required.

Three of the most recent examples of this class of machinery are those in operation at the South Metropolitan Gas-Works at East Greenwich, at the Melbourne Gas-Works, and at the Aberdeen Corporation Gas-Works—the latter in a retort-house 369 feet long, containing 16 double settings of eight ⏛ retorts, with regenerator furnaces, as also about 12 double settings with ordinary furnaces. The Aberdeen machinery is practically a reproduction of that in operation at Blackburn and Beckton, with the exception of the coal-breakers. These we had to make specially large and strong to deal with the great and exceedingly tough lumps of the hardest of Scotch cannel. Upon trial of the first of them, we found we had arranged to break the coal in rather smaller pieces than Mr. Smith desired; so we had to alter the pitch of the claws in the whole of them—a circumstance which delayed the completion a little beyond the specified time. From a return Mr. Smith gives me of his working, I understand he is making a very substantial saving over his previous system of hand labour, although the machinery is only in partial operation; and I am in hopes of his favouring the members with a little of his experience.

I wish, however, to point out that the drawing and charging machines are made exceptionally strong—stronger than our earlier machines; for experience has taught us that, for retort-house work, where everything has to be kept going night and day, the ordinary engineers' rules are not adequate to the requirements, and it has been found necessary, in order to avoid any risk of mishaps or breakdowns, to make a large number of the parts of cast and Bessemer steel, and the bearings very long, and, in most cases, of gun-metal. This, of course, makes the machinery more expensive in first cost, but reduces the wear and tear to a minimum.

There are one or two points of vital importance in the designing of retort-houses for machinery. In the first place, let me impress upon you the necessity of having mouthpieces of the same section throughout as your retort; in fact, an increase of the section by ⅛ inch all round would be a great advantage. If the mouthpieces are at all contracted, the coke often jams hard in them; and if the drawing-machine is powerful enough to overcome the obstruction, and draw the coke out at one stroke, it throws a great strain on the mouthpiece bolts, and through them on the whole face of the setting. Therefore, in designing my drawing-machines, I have arranged that the power at disposal for drawing out the coke shall not be greatly in excess of that required under normal conditions. At one or two works—notably at Beckton and Birmingham—I have had to draw and charge by machinery retorts with contracted mouthpieces; and the experience I have had makes me speak strongly on this point. Again, the differences in section of retorts at different works, and very often at the same works and in the same house, are a great drawback to working machines economically. All the retorts in a house should be of the same section; and every retort in a tier should be at the same height from the floor. When these details are carried out, you get the best results; and by adopting, when making renewals, a section of retort to which either manual or power machinery could be equally well applied, the introduction of machinery in the future would not be accompanied by any additional expense beyond that incurred in purchasing it.

From large experience in the working of all kinds of settings, I am fully convinced that the best sizes of retorts for small and medium-sized works are those recommended by me when my manual machines were first introduced—viz., 21 in. by 15 in., 21 in. by 15½ in., 22 in. by 15 in., 22 in. by 16 in. ⏛ shape. These sizes will be equally suitable for working either with or without machinery. In larger works, where power machines can be economically employed, a somewhat larger variation can be allowed for. Any section of retort can be charged by the power machines, but the sizes most suitable are: 21 in. by 15 in., oval; and 20 in. by 15 in., 21 in. by 15 in., 22 in. by 15 in., and 22 in. by 16 in. ⏛ shape.

The retort mouthpiece lids require special attention, as they must be arranged to close back to allow the machines to pass. The distance from the face of the retort-stack to the machines is 2 ft. 6 in.; and the lids and fittings will be required to fully clear this, both when they are open and when they are closed. Again, the hinges should be made so that the lids are closed in the same direction as the machines travel when at work.

The next point to be considered is the space for the machinery to work in. Supposing a retort-house was being designed for machine stoking, I should recommend, for 20 feet through retorts, that there should be a space of at least 21 ft. 6 in. between the retort-stack and the wall or the face of the roof-columns. For power machines at each end of the house, there should be a space of 18 feet from the vertical centre of the end retort to the face of the end wall of the retort-house, to admit of the whole of the retorts being drawn and charged. For manual machines the space between the vertical centre of the end retort and the face of the end wall of the retort-house should be 11 ft. 9 in. The height of the roof should be sufficient to clear the top of the elevators. The height from the floor-line to the top of the elevators, measured at a distance of 11 feet from the face of the retort-stack, is 32 feet, at which height all roof principals and tie-rods should be clear. This dimension is supposing the retorts are arranged in three tiers. If for four or five tiers of retorts, for which the machines are sometimes arranged, the height of the elevator must be increased proportionately according to the height of the top retort from the ground-line. The most economical method of designing a retort-house of small size, to be worked by a minimum number of men and machines, is to have single retorts—say, 10 feet long—so that only one coal breaker and elevator and one set of machines would be necessary. A good example of the application of machinery to small gas-works is that designed by Mr. W. A. Valon for the Westgate and Birchington Gas Company, where

the annual make of gas is about 18 millions.* If the rope system of driving the machines is adopted, I advise the driving-engine to be fixed at one end of the retort-house, and preferably in a line with the retort-stack. This engine should be in a building outside the retort-house, if convenient; but the system of rope transmission is such that the engine may be fixed in any other convenient position. At the end of the retort-house farthest from the engine, there should be room for the rope-tension gear, which is fixed beyond the end of the retort-house for a distance of 10 feet.

Although I have given you these dimensions as applying to the best house for machine stoking, it is by no means impossible to apply machines to retort-houses where the working spaces available are much less than those named. A number of instances can be pointed out where they are working 20-feet retorts with a space of less than 20 feet between the stack and the wall; and if the retorts are of less length, the space required can be reduced in proportion. Sometimes where space at the end of the retort-house is unavailable, the machines are run out of the house at the ends. With regard to the height of the elevators, these have often to be arranged to go between two roof principals, and occasionally through the roof itself; or other modifications have to be made to suit the circumstances.

With the view of endeavouring to meet your wishes, I have recently obtained working results, giving the cost of labour and wear and tear, from a number of engineers at works where either my manual or power machinery has been in operation several years. In some instances, where the hand and machine systems are in joint operation, I cannot get complete returns, because of the difficulty of separating the gas produced under the two systems, and the trouble of keeping separate records of weights of coal. But in these cases they inform me that they will be pleased to speak most highly of the machinery, and will be glad to give any information in their power. I think, however, that the many facts laid before you from a large number of engineers, with whom most of you are personally acquainted, testifying to the excellent results obtained by the adoption of the system, prove conclusively that the time has arrived when, if you wish to be in the first rank of progress, it will be necessary for you to adopt these labour-saving appliances.

The author then gave some recent returns he had received from a few gas-works where his manual machinery is in operation. Summarizing the particulars furnished, he stated the relative difference in cost between hand labour and manual machinery to be as follows:—

	Machinery, per ton.	Hand Labour, per ton.	Saving by Machinery, per ton.
	s. d.	s. d.	s. d.
MAIDSTONE—			
Total cost of carbonization . .	1 5·75		
Add interest, wear and tear, &c.	1·50		
	1 6·25	2 9	1 2·75
TUNBRIDGE WELLS—			
Total cost of carbonization . .	1 6·97		
Add interest, wear and tear, &c.	1·50		
	1 8·47	2 9	1 0·53
RAMSGATE—			
Total cost of carbonization . .	1 6·40		
Add interest, wear and tear, &c.	1·50		
	1 7·90	2 9	1 1·10
WESTGATE—			
Total cost of carbonization . .	2 1·00		
Add interest, wear and tear, &c.	1·50		
	2 2·50	3 3	1 0·50
FOLKESTONE—			
Total cost of carbonization . .	1 8·19		
Add interest, wear and tear, &c.	1·50		
	1 9·69	3 0	1 2·31

Referring to these figures, Mr. West said: I wish to call your special attention to the wear and tear account at the above works, which only averages 0·64d. per ton of coal carbonized by manual machinery, and certainly not more than would take place upon the whole system. With power machinery the wear and tear has been somewhat greater, especially where the retorts and mouthpieces were not of a suitable section for machine work. Where retorts are arranged under our directions or put up suitable for machine work, we are prepared to keep the machinery in repair for 5 per cent. per annum on the total outlay of machinery.

I also give you a quotation to be found in Mr. May's (Richmond) presidential address, in February, 1890, to the Southern District Association of Gas Engineers and Managers:—

> May we not, in our own domain of gas manufacture, look forward to the increasing use of machinery, and to its more rapid perfection, in the immediate future? Even at the present time it seems strange how comparatively few works have adopted the facilities for mechanical stoking which are in existence. At Richmond, West's manual power machinery has been employed for some years with excellent results. The wages for carbonizing, including all charges from the coal-store to the coke-yard, are about 1·80d. per 1000 cubic feet; the interest and wear and tear of machinery come to 0·17d.; making a total of 1·97d. per 1000 cubic feet. This, so far as I have been able to learn, shows a saving of 10d. per ton of coal carbonized as compared with hand labour. The increased make, through more expeditious working and even distribution of the charges, is well worthy of consideration the sale of 16-candle gas per ton of half Newcastle and half Yorkshire coal at Richmond during the past two years averaging 10,300 cubic feet.

* These works were described in the JOURNAL, Vol. XLVI., p. 112.

Most of the above machines work off five charges in 24 hours—the charges varying from 300 to 336 lbs. per charge; so that the make per retort is very high, and hence a considerable saving in plant. Since these figures were given, I believe stokers' wages have increased in the southern district; but the same relative advantages will exist between hand and machine work.

I also append return given in my last year's paper to The Gas Institute [see JOURNAL for July 1, 1890, p. 18].

The author next gave some returns as to the working of his compressed air and rope-power machinery; the relative difference in cost between hand labour and the machinery being as follows:—

	Machinery, per ton.	Hand Labour, per ton.	Saving by Machinery, per ton.
	s. d.	s. d.	s. d.
WHITWOOD—			
(*Compressed Air Machinery.*)			
Total cost of carbonization . .	1 1·90		
Add interest, wear and tear, &c.	2·50		
	1 4·40	2 9	1 4·60
SOUTH MET.—EAST GREENWICH—			
(*Rope Power Machinery.*)			
Total cost of carbonization . .	1 1·14	2 5	1 0·86
Add interest, wear and tear, &c.	3·00		
	1 4·14		
ABERDEEN—			
(*Rope Power Machinery.*)			
Total cost of carbonization . .	1 6·44		
Add interest, wear and tear, &c.	2·50		
	1 8·94	2 7	*10·06

* These figures show a very substantial reduction for the small number of retorts (96) worked upon; and when in full operation, there will certainly be a greater saving in these works than was originally estimated for.

Coal Breaking, Elevating, and Conveying Machinery.

As previously stated, I believe I was the first to see the necessity of applying coal breaking, elevating, and conveying machinery, both in connection with stoking machinery, and also for breaking and conveying only; and the first example I carried out was for the Folkestone Gas Company in the year 1881, under the direction of Thomas Hawksley, Esq., the Consulting Engineer. The coal at these works was delivered at one side only of the retort-house, which caused a very considerable amount of wheeling to the far end of the other side of the house. This, however, was overcome by carrying a conveyor across above the retort stack. I saw this machinery last week, and found it in very good order.

Referring to the drawings I have here, one shows an arrangement which we carried out about six years ago at Belfast, and which does its work very satisfactorily. It was for the special purpose of elevating and conveying the coal from a store in a corner of the works, a long distance from the retort-house, both for supplying coal to my stoking machinery, and for delivering coal from the hoppers into waggons for serving other portions of the works in the case of a stoppage in the coal supply. The saving in this case was very considerable, besides dispensing with the difficulty of having the men on the ground floor wheeling the coals in a portion of the yard which was already confined for space for the ordinary operations that were going on. Another is an example of the Cheltenham Gas-Works, where the stores are some distance from the retort-house, a road running between them. Very considerable saving in labour is made by the arrangement at these works. Then there is another example, at the Whitwood Chemical Works. Another drawing shows two long elevators and conveyors at the Sheffield Gas-Works, running from the railway sidings, over the yard, through a wide coke-shed, and across the retort-benches, delivering the coal direct into hoppers in connection with my power drawing and charging machinery. We have also many other examples of a similar character, as will be seen from the numerous drawings before you.

One of the latest and most perfect examples of this particular branch of breaking, elevating, conveying, and storing coal ready for use, is that which I erected at the Higginshaw works of the Oldham Corporation last year, the drawings of which are on the walls; this being absolutely the first example of the complete application of machinery driven by one engine for the purposes intended. The coal-store at the works is 220 feet long by 60 feet wide; and the railway runs along one end only. There used to be turn-tables opposite the doors of each coal-store; and from these turn-tables the railway trucks were drawn into the stores by a horse—very considerable expense being incurred in unloading and stacking the coal. Before the introduction of the machinery, from 12 to 20 men and one horse were required, according to the season; whereas three men now do the whole of the work, including the keeping up of steam in the boiler and the unloading of the waggons.

The different operations may be briefly stated as follows: The coal waggons are run over a large hopper capable of holding 10 tons; and are hoisted up at one end by an overhead crab and gearing, driven from the engine shafting, until all the coal runs out. At the bottom of this hopper is one of West's patent coal-breakers with combined engine, supplied with steam from a stationary boiler; and this breaks all the large lumps, letting the smaller coal pass through. As it does

so, it falls into a pit immediately beneath the breaker in which the lower end of an elevator works; the elevator being driven from the engine shafting. This elevates the coal through an opening in the end wall of the stores, and delivers it on to a conveyor band extending the whole length of the stores, and driven from the same shafting as the elevator. In order to deposit the coal where required in the store, a throw-off carriage is provided which can be moved to any position.

The average of a number of tests with different kinds of cannel and coal, as to the breaking, elevating, and conveying capabilities of the apparatus, is about 38 tons per hour; or if Newcastle coal were alone used, each set of apparatus would deliver into the stores 50 tons per hour, or about 2000 tons per 24 hours.

The original cost by hand labour and the present cost by machinery are as follows: *Hand Labour*—Wages and fodder, 4d. per ton. *Machinery*—Wages, wear and tear, interest, fuel, oil, and waste, 1·77d. per ton.

Other drawings here show the coal breaking and elevating arrangements in connection with inclined retorts at Rochdale, Birkenhead, and Burnley. We are now carrying out a large order for the Birmingham Corporation, at the Windsor Street works, for breaking, elevating, and conveying coals into a continuous hopper. It may also be interesting for you to know that we have received additional orders for stoking machinery worked by compressed air for the Saltley works of the Birmingham Corporation.

A very great saving can also be made in the handling of coke by machinery; and I have done a considerable amount of this class of work. There is a good example of coke stacking at Belfast, where the coke is handled by hydraulic cranes; and I learn that Mr. Hack, of Birmingham, is about to erect machinery upon a large scale for this purpose, and I have no doubt that he will soon see the advantages arising therefrom.

Inclined Retorts and the Cost of Working.

In recent times, another system of stoking has been prominently brought before gas engineers and the general public; and it therefore becomes advisable to make a comparison, not only between stoking by hand and by machinery with horizontal retorts, but also between the working of machinery with these and the new system of inclined retorts aided by machinery as well. There are several modifications of the inclined retort system, commencing with that of M. Coze, and including those of Messrs. Morris and Van Vestraut, using coal breakers, elevators, trucks, and shoots only, and that of Mr. Trewby, where a patent charging-plate is employed in addition to the breakers and elevators.

Several gentlemen have been comparing the inclined retort system against hand labour with horizontal retorts; but their figures only represent a fragment of the cost of the retort-house work. Other gentlemen have been comparing the system against both hand labour and machinery; and in endeavouring to do this, they have shown clearly that they are not well versed in the subject of machine stoking. Before making any comparison myself as to the cost of working these various systems from the figures which have been presented to us from several sources, I feel bound to criticize the system itself; and in doing this I shall give my opinion based on absolute facts obtained from practical results and observations in connection with the carbonization of coal.

I shall first refer you to the results of my early experiments with the setting of short retorts with mouthpieces at each end. With these settings, as previously explained, the mechanical arrangements were most satisfactory; but I was reluctantly compelled to abandon the scheme, because I could not get the same results off the same space (although the fuel account was much increased) as I was then obtaining from the old system of working. Yet with the very same retorts, after the mouthpieces at one end were taken off and the retort stopped up with 14 inches of brickwork, good results were realized. These facts, gentlemen, point to the great loss of heat which took place by radiation from the retort mouthpiece and ironwork, and the effect produced on the gas inside the retort. There is no doubt whatever that the hot gases coming in contact with the mouthpieces at the end, caused a condensation of the gases, and that a quantity of the light-giving hydrocarbons were deposited in this mouthpiece and the end of the retort to which it was attached. The gas then (after being cooled) had to travel back over the hot coke to the ascension-pipe, with further injurious effect.

Now, gentlemen, I will ask you to look at the retort with which I was experimenting, and I will put this question to you: What is the difference between this and the inclined retort? Is not the only material difference the inclined position? Therefore, is not this system liable to one and all of the disadvantages attendant upon mine?—in fact, I should assume in a greater degree, because their gas has to travel downhill before it gets to the ascension-pipe. M. Coze, however, appears to have discovered from his experiments that there was a considerable loss in radiation from his shoots; for, on the authority of Mr. Van Vestraut, it has been found necessary for these iron shoots to be surrounded by brickwork. Yet in his own system he has ignored the necessity. He also points out that it is essential to this system, in order to burn off the charges, to adopt gaseous firing to ensure the equal heating of the retorts. For my own part, I am satisfied that retorts upon the inclined system could not be heated in the ordinary way of firing, and that it is absolutely necessary for them to have a large excess of heat to make anything like a return in the quantity of gas produced, which means a very extravagant waste of fuel.

It must not be forgotten that my old friend, Mr. Carpenter, of Sheerness, with whom I have been intimately connected for many years, spent a very considerable amount of time and money in trying to work out a system of inclined retorts (and I cannot see any material difference between his arrangement and that which has been recently brought to notice); and he found that, with the most careful manipulation in putting the coal into the retorts, he could not always secure very regular distribution, and that the tar deposited in the mouthpieces, and its liability to get mixed with the coke, were defects which would require to be surmounted.

I believe I have carefully read the whole of the literature which has been volunteered in reference to this system, besides having had the opportunity of seeing it in operation at various works; but, up to the present time, I have not heard of any complete experiments being made anywhere giving (1) the make of gas per ton of coal carbonized, (2) the illuminating power of the gas, (3) the fuel used, and (4) the total cost of carbonizing wages. I beg to submit that these are facts you ought to know before you can judge of the merits of the scheme; and until these particulars and the total cost of the installation of the system are ascertained, I cannot see how you can satisfactorily compare it, either against the old system of working, or against the statements which I have laid before you showing the cost of the working of machinery upon the horizontal system. I therefore venture to suggest to you that if ever there was a system that your "Committee of Investigation" should go fully into, it is this one. I do think, and I have advised, that in large undertakings a few trial settings should be erected as an experiment; and these should be thoroughly tested in every respect in the way I have indicated.

With long retorts, like those Mr. Hunt, of Birmingham, is erecting, the question of radiation may be partially overcome; in which case the question will resolve itself in large works into the relative advantages of working each system, taking the weight of coal and volume of gas produced, and all charges, from the taking of the coal from the stores to the delivery of the coke into the yard.

There appears to be very considerable doubt as to the angle at which the retorts should be erected; and various angles are suggested. The difficulty appears to me to be insurmountable when you have a large variety of coal and cannel to deal with; and it seems that it will be found necessary to have some mechanical appliance to ensure success. Of course, my own opinion is that the *right* angle from the face of the stack will still be found to be the best angle.

As to the much-talked-of benefit or comfort the workman can derive from the working of the system, I have failed to discover that he very much appreciates working on the top of the retort-benches or between them, where he is subjected to the smoke, sulphur fumes, and intense heat from the retort-settings that surround him, and which in some cases is even as high as 200° Fahr. Those of you who have not seen these men at work in these positions, ought to do so, without which you cannot fully appreciate my remarks.

[The author next quoted the tables contained in Mr. M'Minn's paper, read before the Incorporated Institution of Gas Engineers, and published in the JOURNAL for May 19 last, showing the comparative cost of labour with the horizontal and inclined retort systems.]

It may be said that I am somewhat prejudiced on the subject. There is no reason why I should be so, as I have been favoured with a fair number of orders for breaking, elevating, and conveying machinery in connection with this inclined retort system; and I believe I have the sense to know that no words of mine will prevent the "survival of the fittest." What I strongly recommend to you, as practical engineers in charge of important undertakings, is to thoroughly test and weigh in the balance the various schemes, and adopt that which is best.

I am very gratified, after so many years of persistent working in connection with stoking machinery, to find that I do not have to rebut the criticisms and meet difficulties that I had to contend with in former days. In some cases during the good old times, when there was no competition, some managers were, I think, too much inclined to "rest and be thankful." One friend of mine indicated that he liked me and also my machinery very well, but he did not see what advantage it would be to him, as he was paying his maximum dividend, and still had a large balance to spare. I, of course, suggested that he should reduce the price of gas to the consumers. But he remarked that the public were not very grateful for what you gave them. While believing you must not expect many thanks from the public, I do hold strongly that all gas companies and corporations having the charge of a regulated monopoly have very strong obligations towards the public; and, while securing a return for their investments, they should use the best known means in their power to reduce the price of gas to the public. This feeling now seems to prevail universally amongst engineers. There appears, however, a desire in some quarters (it may possibly be for political or other motives) to keep thepublic from having cheap gas, by trying to prevent the

introduction of all modern labour-saving appliances. To all such I would say that they will not be able to obliterate the word "Excelsior."

Discussion.

The PRESIDENT said the members had listened to a very interesting communication. As they had heard, the Research Committee had visited the Aberdeen Gas-Works with the intention of presenting a report; but, on consideration, they thought this would not be necessary, more especially as Mr. West had agreed to read a paper, and as Mr. Smith was going to give the meeting copious notes on the working of his machinery.

Mr. ALEX. SMITH (Aberdeen) said he thought this was the first time the Association had had before them the subject of mechanical stoking, at all events so fully as Mr. West had presented it. He wished just to say, before he gave the members the results of the working of the machinery at Aberdeen, that, in the course of his travels some time ago, he came across, in England, the machine invented by Mr. W. Foulis, of Glasgow. It was strange that he should meet with it there. So far as he could see, it was doing its work well; and it appeared to him to be an extraordinary thing that the appliance should be working in England and not in Scotland. He went over to the party in charge of the machine, examined it, and asked the man how he liked it. The man replied that the machine was "doing good and honest work." This was one of the things he (Mr. Smith) could not get over, why the machine stopped in the Glasgow Corporation Gas-Works. It showed that they had not insisted enough upon it in Scotland, and that they could not hope to introduce any new thing unless they took personal supervision of it. They could not leave the introduction of new things to foremen and workmen, for they would bring forward all sorts of objections, and everything would be put in their way. He [therefore resolved, when he took Mr. West's machinery on trial, that he would follow it out night and day himself, as far as he was able to do so; because he felt that, if he did not, the trial would prove a failure. They resolved to introduce four coal-breakers, two drawing-machines, and two stoking-machines. He thought he could truly say they gave Mr. West a "wrinkle" or two when he was in Aberdeen. [Mr. WEST: But it cost me something.] He did not think Mr. West ever saw a three-hour charge carried on with the heats and quantities of coal they put in there. As Mr. West was too long in erecting the plant, and they were having coal strikes and coals that were not of very good quality, he was almost obliged to have the whole of the retort-houses worked with this machinery. They took a section of 96 retorts, which were charged for three hours with 2½ cwt. of coal. This was at the rate of about a ton per 24 hours. During the old process, they had 71 men engaged in the work. These men cost every week £86 16s.; and, with a quantity of 672 tons of coal, this came to 2s. 7d. per ton. After the new system had been adopted, the number of men was reduced to 42; and the wages then paid amounted to £51 13s. There was some advance in the rate of pay, because the old men were put on the machine, and were allowed a little more on this account. The 672 tons of coal were carbonized at the rate of about 1s. 6d. per ton. He was sorry he could not give the quantity of gas made per ton of coal. Previous to this they bought cannel coal, which produced a large amount of gas; and they used to average from 10,300 to 10,500 cubic feet per ton of a fair quality of gas. But in the last few years they had been having cheaper coal, which only yielded from 8000 to 9000 cubic feet. Therefore he did not think it would be fair to give a comparison until they had a year's work with the same kind of coal. He could put before them, however, this very important point: He had observed that, by charging the retorts with the aid of machinery, he could keep in the coals about eight or ten minutes longer than when they were put in by hand. The members must understand that this meant an increased quantity of gas. With regard to the coal breakers, they experienced little difficulty with them. They had Muirkirk coal to deal with; and it had been stated over and over again that the machines would send the cannel all to pieces, and reduce it to dross. He asked one of his men on the previous day to take up the coals as they came out of the machine; and it would scarcely be believed that there was hardly any dross. It was a matter of wonder to him that the system of charging and drawing by machinery had not come sooner to the front. He found that it was 41 years since the subject was introduced; and the idea lay dormant until Mr. West and others took it up. He believed it was a really excellent system; but, as he had said, anyone who adopted it must go into the matter with personal supervision, if it was to be a success. In conclusion, he had only to state that all the machinery had fully come up to his expectation.

Mr. W. A. VALON (Ramsgate) said he had been greatly interested in the paper before them. The figures he had been able to give from the Ramsgate Gas-Works had been taken out by an accountant; and, whether they were favourable or unfavourable, they were just as they appeared in the books. He thought Mr. Smith had gone into the matter so elaborately that he (Mr. Valon) need not to say very much. He had only to remark that, as a matter of fact, Mr. Smith's experience had been somewhat similar to his own. He was one of the earliest to adopt the machine, which he saw was a step in the right direction. He thought that a great point in its favour was that the wear and tear had been very small. He anticipated that for the first year it would be a great deal more than it was. With regard to the quantity of coals they could put into the retort, he wished to explain that it was only limited by the amount they could take out. He thought the coal in Scotland shrank, so that whatever they put into the retort they could get from it. The reverse was the case in England. The coals there swelled; and the result was that they could not put in so much as they otherwise would do. However, they were now able to charge more than they did before. While on this point, he wished to refer to Mr. Smith's questioning of their economy in England in allowing the coals to remain for six hours in the retorts. When they were using cannel coal, they sometimes did so; but they drew the retorts every three or four hours when they were dealing with ordinary coal. They found five or six hours the utmost limit. It depended entirely upon the quality of the coal. He saw that Mr. West had the figure 3·17d. for hand work at Ramsgate. This was less than the cost.

Mr. WEST: That is what I really want to know; I want your information.

Mr. VALON said they calculated it would cost them about 3¾d. per 1000 cubic feet, or 4½d. in small works; so that the saving by the machine would be more than was put down. He noticed that Mr. West's machinery was driven by compressed air, and also by wire rope; but he must say that, so far as he was concerned, he thought the manual machines, with the maximum of labour, were handier than either air or wire-rope machines. He was speaking a little in the dark on this matter, because he had never worked them; he was only judging from the saving he effected at Ramsgate with the manual machine compared with what was done elsewhere by using the air machine. There was another great point in favour of the manual machine—viz., that it could be adopted in the smallest works. For example, there were the works at Westgate-on-Sea, where they carbonized only 1600 tons of coal in the course of the year, and where one man did the whole of the duty. In the summer he drew the retorts and did everything. With regard to inclined retorts, he agreed with Mr. West in the opinion he had given of them. He (Mr. Valon) had visited most of the places where retorts set on this plan were worked, and he did not think there had been an advance on the position twenty years ago. He had great doubts as to the economy that would be effected in fuel; and he was sure that the cost of operating them would be a great deal more than it would be for working West's machinery. To his mind, this machinery was the "survival of the fittest." He certainly thought it was impossible to put anything like the same quantity of coal into an inclined retort, and work it, as could be placed in a horizontal retort. It was not, perhaps, fair to criticize a system which had only just been seriously worked; but he must say that what he had seen of it up to the present time had not been very satisfactory to him. He agreed that it was a reproach to gas engineers that Mr. West's machine should have been so many years in the market without having been more generally adopted. If the electric light would only drive gas managers into doing their duty in this respect, it would be something to be thankful for.

Mr. A. MACPHERSON (Kirkcaldy) said he was one of the deputation from the Committee of the Association who visited the Aberdeen Gas-Works to inspect Mr. West's machinery; and all he had to say about it was that they were unanimously of opinion that it was a success. It certainly did its work in a splendid manner. Mr. Smith put himself to the trouble of giving them a thorough insight into all the details; and the Committee were highly satisfied with the whole of the arrangements. They considered that Mr. Smith had done for the Corporation of Aberdeen the best thing it was possible for him to do, and that Mr. West deserved very great credit. There was only one thing he would like to ask gentlemen who had had experience with the machinery, and that was whether, in working the manual or the other systems, there was any difficulty with the carbon that would collect in the retorts, or whether it was kept down by drawing. It might be of advantage if Mr. West would tell them something on this point.

Mr. W. KEY (Tradeston, Glasgow) said he would much like to make one observation on Mr. West's machinery. He had visited the Aberdeen Gas-Works as a member of the Committee of the Association, and he must confess that he was greatly pleased with the excellence of the machinery. One feature which struck him in connection with the coal-breaking arrangement was the wonderful way in which the large coal was reduced to pieces of the size required.

Mr. D. TERRACE (Middlesbrough) said there were one or two points to which he wished to refer. The first was as to what had been stated about the heats prevailing in the retorts in England, where six hours were, it was said, required for working off a charge. This was not the case with him, for he had been able to work off Newcastle coal in three hours; and if they did this in Scotland, why should they not do it in England? In his opinion, the superior heats had nothing to do with the question at all. He did not agree with Mr. West in some of his remarks about the inclined retort system. He (Mr. Terrace) was trying this system on a small scale at Middlesbrough, and he thought it would be a pity if the statement made in the paper should go unchallenged. The right thing to

do, as Mr. West admitted, was to give both systems a trial; and then experience would teach which was the best.

Mr. T. D. HALL (Montrose), as a member of the deputation to the Aberdeen Gas-Works, said the first thing that struck him was the facility with which the breaking-machine reduced the large lumps of cannel coal into small pieces. The drawing and charging machines, so far as he could see, were perfection; he thought it was all very creditable to Mr. West.

Mr. WEST, in reply, said Mr. Smith had kindly told the meeting that he had searched England through, and had decided that his (Mr. West's) machinery was the best, and that, like a thoughtful man, he would test it. He (Mr. West) was very pleased to hear once again from Mr. Smith that the machinery was acting very well, and giving satisfaction. Mr. Smith would see, as he went on, that the work would improve. He would find that there would be greater economy the more retorts he worked the machines to draw and charge. Mr. Smith had mentioned something about the hydraulic machinery. Well, he did not know whether he ought to say anything about that or not, but they did work the machinery in Manchester, and it was working there now. He considered that they had improved it very much; and he thought he had given them a "wrinkle"—that it was advisable to bring the coal to the machines by mechanical means. When he was appointed Chief Engineer to the Manchester Corporation, some years ago, seeing that he was a kind of rival to the hydraulic machinery, he made up his mind that it should not suffer in his hands; and he thought he produced better results with it after he went there than had been obtained from it before. Of course, all these machines had their various merits; but he naturally had a very firm conviction that what he was advocating was the best. The question of coal breaking was, no doubt, a very important one; and he must admit that the cannel breaking at Aberdeen was a tough job. Mr. Smith sent some samples to Manchester, and they tried them. They did not get all the pieces to go in the right way of the grain; but the machinery in their works seemed to work it better than the machinery in his works did. The chief difficulty was that the coal was broken too small. There were no defects whatever in the machine; the only thing was that they were in ignorance as to the way to do it. These machines had certainly taxed his brain power beyond measure. It was not very easy to meet all sorts and conditions of things in cannel breaking. They had blocks like pieces of timber; and the idea was not to pound it up, but to crack it, so as not to make it too small. With Newcastle coal, or any other coal like that, it did not matter; and this was the sort of stuff with which he had been accustomed to deal. So that he had really had no experience of cannel until he went to Aberdeen. Although in Manchester they had 25 different kinds of coal—cannel coal being amongst it—he never came across anything like what he had to contend with in Scotland. He was very much obliged to Mr. Valon for what he had said about wages. He knew what Mr. Valon had been doing; but he thought it better to be on the right side. They had heard what Mr. Valon had said about moderate sized gas-works. This was a very important matter for them in Scotland, where they had so many small works. Mr. MacPherson had asked a question about the carbon in the retorts. He (Mr. West) did not know that using machinery made any great difference. The rake going in cut the carbon to a greater extent than was done by hand; and the scoop scraped it off the sides, and did not allow it to accumulate at the same rate as it did with hand charging. When it formed—and it always did form—every charge tended to rub it off. When the carbon came to collect in such quantities as to be positively detrimental to the working, there would be a thickness of about 1½ inches on the side of the retort; and all he could say was that when this was the case it was time it was taken off, because they had to conduct their heat through it. Mr. Terrace had spoken of Newcastle coal, which, he said, was used in the South. He might tell Mr. Terrace that there was a great difference of opinion about the matter he had mentioned. He for years worked off four-hour charges; and he tried to force them upon his friends in the South. But for a long time they had gone back to five-hour charges. They seemed to find that, taking everything into account—stopped ascension-pipes and everything else—it was best to put more coal into the retorts, and reduce the heats a little. The question there, however, was what was the result. They might not do the work in the same way; but if they arrived at the same result, where was the difference? He (Mr. West) thought the four-hour shift was the more preferable. Mr. Terrace had alluded to inclined retorts. Well, what he said was that the result of his experiments with these retorts was that there was a considerable loss of heat by radiation through the two mouthpieces and from the larger surface of the stack. If they could prove to him that he was wrong, he would acknowledge it. The retorts were on their trial; and he suggested to the members, as practical men, that they should make comparisons, and take everything into their calculations, before they came to a conclusion. For himself, he would not compare them. When he was asked to do so, he simply put himself into comparison with the figures which had been presented by advocates of the inclined retort system; and he said that, as the result of practical experience for many years, he could beat them in every shape and form.

Mr. SMITH (Aberdeen) asked to be allowed to reply to a remark made by Mr. MacPherson. He could not say that there was very much difference in the quantity of carbon formed with hand and with machine working, with the exception of the top retorts. The men could not get up to these to take it out properly; but the machine cleaned them thoroughly, and therefore they were better than the hand-charged retorts. But, of course, they would always have carbon on the retorts.

The PRESIDENT said he did not think any remarks he could make would add to what the members had heard in the interesting discussion which had taken place; and therefore he would confine himself to moving that they accord to Mr. West their very hearty thanks for his paper.

(*To be continued.*)

THE MEETING OF THE BRITISH ASSOCIATION.

The 61st annual meeting of the British Association will open in Cardiff on the 19th inst., under the presidency of Dr. W. Huggins, F.R.S. As the President is one of the most eminent astronomers living—his spectroscopic researches on the celestial bodies having yielded very brilliant results—it is expected that his address will deal mainly with the work of his life. With regard to the sectional business, Professor Oliver J. Lodge, F.R.S., will preside over the Mathematical and Physical Science Section; Professor Roberts-Austen, C.B., taking charge of Chemistry. In the latter Section, explosions in mines will form a subject for discussion, in which Sir F. Abel, Professor H. B. Dixon, and Professor V. B. Lewes are expected to take part. The presidential address of Professor T. Rupert Jones in the Geological Section will probably deal with the origin of coal; the question to be discussed being whether this mineral originates, like the other sediments among which it is found, through the deposit of vegetable matter under water, or whether it is due to the growth *in situ* of forests in such parts of a delta as were above water. In this section there will also be a paper on the origin of petroleum in rocks. The President of the Mechanical Science Section is Mr. T. Forster Brown; and his address is expected to deal chiefly with mechanical appliances associated with coal mining, with special reference to South Wales. The following gentlemen have promised papers on the subjects named, for this section: Mr. G. Chatterton, on the main drainage of the Rhondda Valley; Mr. H. Davey, on a new method of procuring underground water for the supply of towns; Mr. H. Faija, on peculiarities observed in, and methods of testing, cements; Mr. W. Anderson, on purifying water by iron in a revolving purifier; Mr. W. Robinson, on a petroleum engine; Mr. E. Vernon, on the Bénier hot-air motor; Messrs. Fielding and Platt and Mr. F. Walker, on coal-tips; and Mr. W. Key (of Glasgow), on the mechanical ventilation of buildings. The arrangements include the usual *conversazioni*, a garden party, excursions, &c. A guide-book to Cardiff is being prepared for distribution to all the members and associates; and this, with the excursion hand-book, will furnish a very complete description of everything connected with the portion of South Wales in which the meeting will take place. Professor A. W. Williamson will relinquish the office of General Treasurer of the Association, which he has held since the death of Mr. W. Spottiswoode in 1874, and will probably be succeeded by Professor Rücker.

Mr. J. T. G. Cranshaw has been appointed Gas and Water Manager for the Tyldesley Local Board, in succession to his late father, Mr. Amos Cranshaw, who held the position for 25 years.

The Existence of Coal near Dover.—Speaking at the half-yearly general meeting of the South-Eastern Railway Company a few days ago, Sir E. Watkin, M.P., said the Company had spent some £10,000 in looking for coal near Dover, with the result that, according to their Engineer, they had got through a number of seams of coal to the extent of 10 feet, and it was believed that at a lower depth they would find a 4-feet or 5-feet seam. The core on the table before the shareholders had been taken at a depth of 1500 feet from the surface by a diamond drill; and he had had a box containing samples of coal brought to the meeting for inspection. He then read a report signed by Professor W. Boyd Dawkins, Mr. Tylden-Wright, and Mr. Francis Brady, who spoke very favourably of the prospects of discovering workable coal. They were now contemplating the sinking, at a cost of £30,000, of a permanent shaft which would settle once for all the question of the South of England coal-fields. Professor Boyd Dawkins afterwards addressed the meeting; reiterating the views expressed in the report which had been read. They could, he added, only judge of the future effect of the discovery in question in the south-eastern part of England by realizing the effect which the working of coal had produced in certain parts of Northern France. By penetrating the overlying rocks in that district, a vast coal-field, no less than 90 miles in length, had been revealed; and this field last year produced very nearly 8 million tons of coal, and gave employment to 29,000 men. South-eastern England, in comparatively modern times—in the days of Queen Elizabeth—was a great centre of the iron industry; and it would be a singular instance of the swinging of the pendulum of Fortune back again if they were to have a coal industry and an iron industry again taking root in that part of the country.

REGISTER OF PATENTS.

Stirring and Drawing the Charge of Gas-Retorts.—Foulis, W., of Glasgow. No. 12,016; July 31, 1890. [11d.]

This is an invention of apparatus for drawing the charge from gas-retorts, and also for stirring the charge, for the purpose of breaking up the coal in the retorts, so as to hasten or expedite the process of carbonization after it has proceeded for a certain time.

The apparatus by which these operations are effected consists of a frame or bar mounted on a travelling bogie or carriage, actuated by hand or other power. The frame is so constructed as to enable a slide or carriage to be travelled backwards and forwards, by means of two hydraulic cylinders, suitably fixed to the frame. The carriage has attached to it a rake and rake rod, if the apparatus is to be used for drawing the charge, or flat bars or rods, if the apparatus is to be used for stirring the charge; the rake or bar entering into the retort to draw or to stir the charge therein. The hydraulic cylinders for actuating the carriage are preferably made shorter than its travel, which is obtained by a rope or chain passing over pulleys carried by the frame or bar and rams. The frame or bar and its connections are suitably suspended in the centre, in such a manner as to enable them to be raised and lowered by means of a hydraulic cylinder or cylinders. The action of the whole is such that—in stirring—on the bars being pushed into the retort underneath the coal, they rest on the retort mouthpiece

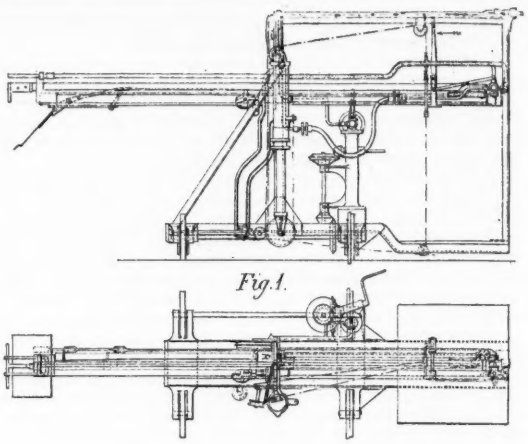


Fig. 1.

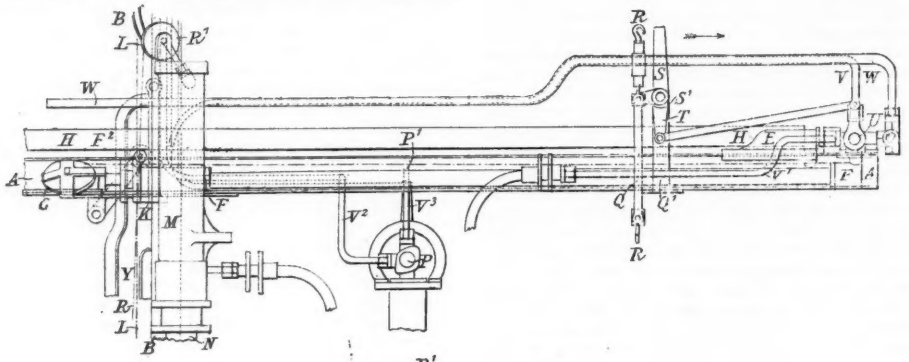
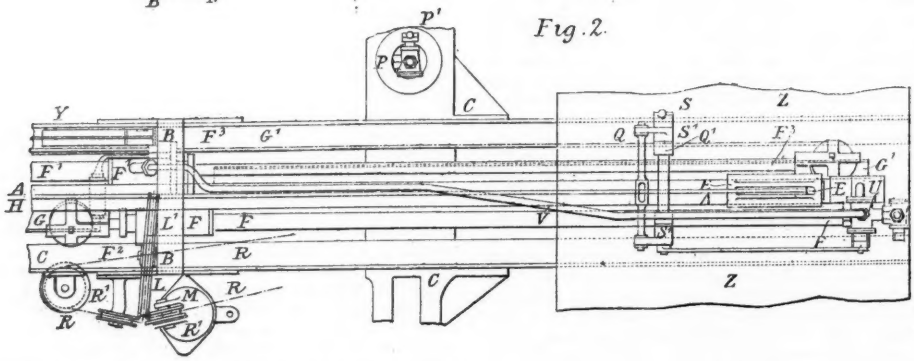


Fig. 2.



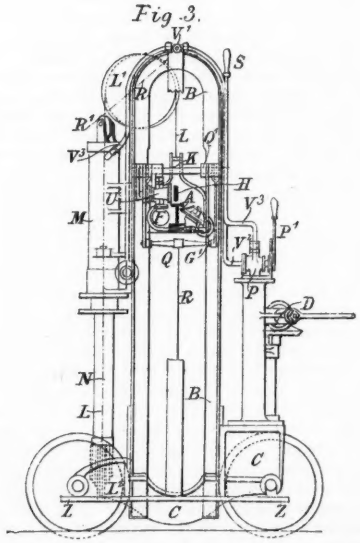
(or they may be caused to rest upon a separate bearing), which will act as a fulcrum; so that when the bars or rods are inserted a sufficient length into the retort, the centre of the frame or bar is depressed or lowered, and consequently the front ends of the bars or rods are raised, so as to break or stir up the partially carbonized coal. When the apparatus is arranged as a drawer of the charge, the rake will be passed in above the charge, and then be caused to descend, so that on being withdrawn the charge comes away with it.

The accompanying illustrations show apparatus for withdrawing the charge entirely from the retorts. As the general features of the two machines are the same—with the exception of the substitution of a rake in the one case for a rod or rods acting as stirrers in the other, and certain minor details incidental to the different purposes of the two machines—it is unnecessary to specially illustrate also the arrangement of the apparatus for stirring.

Fig. 1 is a side elevation and a plan of the general arrangement. Fig. 2 shows a part elevation and plan drawn to a large scale. Fig. 3 is an end elevation of the arrangement.

The frame or bar A is preferably made of an I iron or steel bar, and mounted or suspended at its centre to the upright standard B, of the travelling bogie or carriage C, which may be actuated by hand or other power gearing D. The frame is so arranged as to enable a slide or carriage E being travelled backwards and forwards by means of two suitably mounted horizontal acting hydraulic cylinders F F_1, which are fixed to the frame in such a manner that the necessary travel may be given to the slide or carriage by means of the chains or ropes and pulleys mounted on the front ends of the cylinder rams F_2 F_3. The front ends of the rams are provided with suitable guide or slipper blocks which work in corresponding guide plates G G_1, secured to the frame. The slide or carriage E is connected to the back end of the rake-rod H, which carries at its forward end a rake or plate. The frame is suspended at its centre by means of a carrier K, the top end of which is secured to the one end of a raising or lowering chain L, which after being passed around the guide-pulley L_1 mounted on the standard B, and around the pulley L_2, mounted on the lower end of the ram N of the hydraulic raising and lowering cylinder M, is secured to a snug or projection on the cylinder in such a manner that the whole may be raised or lowered by actuating the valve P, through the medium of the lever P_1.

Fig. 3.



The frame or bar A is supported near its back end by means of block or carrier Q, held in position to the main carrier K by means of chains or ropes R and guide pulleys R_1, by connecting the ends of ropes or chains to the main raising and lowering chain or rope, thus always keeping the two carriers K and Q in their relative positions to each other. The carrier Q is preferably composed of two cross stays connected to each other by two links, and provided with adjustable means for attaching the ends of the chains or ropes R. The top stay is attached

to the ends of two crank levers S^1, secured on a rocking-shaft carried in the top ends of a saddle-piece Q^1, attached to the main frame or bar A. This rocking-shaft is provided with an operating handle S, and the valve-regulating lever T, which is connected to the regulating or reversing valve U. The valve U is connected by piping V to the cylinders F and F^1 (actuating the rake), and is supplied with water by the pipe V^1, a branch V^2 from which also supplies the raising and lowering valve P, which is connected to its cylinder or cylinders by piping V^3. The exhaust or waste water from the valve U is preferably led away to the front end of the frame A by means of piping W, provided with two perforated nozzle pieces which direct the flow of waste water on to the rake and rake-rod, so as to keep them cool.

In order to prevent the coke or coal from being scattered over the floor when withdrawn from the retort, there is connected to the front end of the frame or bar A, a drop plate which is caused to act automatically so as to fit the various retorts, by means of levers, connecting links, and a pulley, the latter of which runs up and down the curved race Y, of the standard B, when the machine is raised or lowered.

The general arrangement and action of the apparatus are such that on the operator (who stands on the platform Z, provided at the rear of the travelling bogie or carriage C) having brought the apparatus in front of the retort from which the charge is to be withdrawn, he manipulates the lever F^1, and so raises or lowers the frame or bar A, and its connections, to the desired level. After this has been accomplished, he pulls the lever S in the direction of the arrow, and so causes the ram F^2 to move forwards, and the ram F^3 backwards. The former pulls the slide E, rake rod H, and rake J, forward with it over the top of the coke, owing to the saddle-piece Q^1 having been depressed by the movement of the lever. After the rake has reached the end of its travel, the operator reverses the lever, and so causes the rake to be depressed down into the coke before withdrawing it; the coke being kept from being scattered by the automatic drop plate already referred to, thus providing apparatus which is simple and effective in action.

When the apparatus is to be used for stirring the charge, the main frame or bar A is preferably constructed of an **I**-shaped iron or steel bar mounted or suspended at its centre to the upright standard B of the travelling bogie or carriage C, both of which are preferably constructed broader than in the case of the apparatus illustrated, so as to permit of a larger slide or carriage than that shown at E being used, and so as to enable the back ends of one or more (preferably three) flat iron bars or rods to be attached thereto. The **I**-shaped frame or bar is raised and lowered by hydraulic power, as described with reference to the frame or bar A, in the arrangement illustrated; and the slide or carriage and bars or rods are actuated horizontally backwards and forwards by an arrangement of hydraulic cylinders, rams, pulleys, and chains, as shown with reference to the drawing apparatus. But in the stirring apparatus the back carrier Q is dispensed with, as well as the saddle-piece Q^1 and their connections (including the chains R and pulleys R^1); and the operating lever S is mounted directly on to the regulating or reversing valve U, as the stirring apparatus is depressed or lowered at its centre, and not at its back end as with the drawing apparatus. This lowering or depressing is effected through the medium of the raising and lowering cylinder and its connections.

Liquid Meters.—Tylor, J. J., of Newgate Street, E.C. No. 13,140; Aug. 21, 1890. [8d.]

This invention relates to improvements in that class of positive or piston meters in which two cyclinders and pistons are so arranged that each piston operates the slide or other valve by means of which the liquid is admitted to, and released from, the other cylinder. The improvements consist in certain means for actuating the valves by the pistons which permit a reduction in the size of a meter to measure satisfactorily a given volume of liquid in a given time.

It is well known, says the patentee, that as the length of the stroke of such pistons is usually considerably greater than that of the stroke of the valves, and as the latter only require to be moved as the pistons approach the end of their strokes, it is necessary to provide for a certain amount of lost motion in the pistons—that is, it is necessary to arrange so that the pistons only move the valves as the pistons approach the end of their strokes in either direction; the remainder of the stroke of the pistons having no action whatever on the valves. According to the present invention, this lost motion of the piston is allowed for by mounting a hollow sleeve on the piston and valve rod; either the piston-rod or valve-rod being free to slide in such sleeve to the extent corresponding to the amount of lost motion required—the movement of the valve being effected by pins or projections on the piston or valve rod coming against stops in the sleeve. In some cases it is possible to arrange for part of the required lost motion being effected by the sliding of the piston-rod in the piston itself, and part by the sliding of the valve-rod in the valve or in a sleeve connected therewith, or by the sliding of the piston-rod in a part connected with the valve, or otherwise to divide the lost motion between the piston and the valve, whereby space and material may be saved. In some cases provision is made for the necessary lost motion by causing the piston-rod to push the valve in one direction by direct action, and to draw it in the opposite direction by means of a chain, cord, or other suitable flexible material, becoming slack when the piston moves in the opposite direction, in order to allow of the required lost motion.

Gas-Engines.—Ovens, W. and T. C., of St. John Street, Clerkenwell. No. 13,352; Aug. 25, 1890. [11d.]

In describing their improvements in gas-engines, the patentees say: In order to facilitate access to the working parts of the engines, the firing light and the admission and exhaust valves are arranged at the same side of the cylinder. Provision for the actuation of the valves is arranged for by means of rods or levers or other mechanism, to which motion is communicated as required from the crank-shaft through cams carried thereby, or through cams or a crank-plate geared to the crank-shaft, or partly through cams carried by or geared to the crank-shaft and partly through a crank or crank-plate geared to the shaft. Where actuation of the valve mechanism is by means of cams carried by the crank-shaft, the cams are arranged so that the valves will be opened at every alternate revolution of the shaft; but where the actuation is by means of a crank-plate geared to the crank-shaft, in some cases the adjustment of the extent of throw of the crank is provided for by securing the crank pin to a slide so mounted in or on the crank-plate as to admit of variation of position of the crank-pin.

For the purpose of cooling the parts in which the inlet and exhaust passages are formed, a chamber or chambers are provided for the circulation of water, either by connecting them with the water jacket of the cylinder or otherwise.

For the purpose of ensuring steadiness of the engine while working, the patentees prefer to make the cylinder and base in one casting; and in the case of vertical engines, to make the base of a form approximating to that of a cup or bowl inverted.

In order to economize labour in the construction of the engine and to provide for ready variation or adjustment of the capacity of the part of the engine in which the mixture of gas and air is fired, the end of the cylinder is closed by screwing it into one end of a barrel of wrought iron or other suitable metal, and closing the other end of the barrel by a screw cap or plug. The barrel thus closed at one end constitutes a box or chamber communicating with the interior of the cylinder, and to this the firing tube may be connected. By removing the barrel, therefore, and substituting a longer or shorter one, the capacity of the part of the engine in which the inflammable mixture is fired may be readily increased or decreased.

APPLICATIONS FOR LETTERS PATENT.

12,321.—Williams, H., "Improvements in gas and similar motor engines." July 21.

12,413.—Clerk, D., "Improvements in gas-engines." July 22.

12,434.—Gledhill, A. H., "Improvements in the method of and means for detecting the presence of coal gas, either in connection with gas motor engines, mines, or with churches, theatres, or other public or private buildings." July 22.

12,490.—Shaw, J., "Improvements in gas-engines." July 23.

12,505.—Hislop, G. R., "Improvements in union gas-burners." July 23.

12,508.—Goehde, R., "Improvements in apparatus for roasting and grilling by gas." July 23.

12,572.—Stevenson, G. E., "Improvements in apparatus for charging inclined gas-retorts." July 24.

12,625.—Neuhaus, M., "Improvements in liquid-meters." July 25.

South African Gas Company, Limited.—Mr. S. Wood, of the firm of Messrs. Alfred Lass and Co., of 30, Gracechurch Street, has been appointed Liquidator of this Company; and creditors are required to send in their claims to him on or before Sept. 30 next.

The Proposed Acquisition of the Calverley Water-Works by the Local Authorities.—At a recent meeting of the Farsley Local Board (Mr. I. Gaunt in the chair), a letter was read from the Secretary to the Calverley District Water Company, stating that they had resolved to reduce the price asked for their undertaking to £20,000, or to refer the matter to arbitration, as previously suggested. A further letter was read from Mr. Dutton, Clerk to the Pudsey Local Board, and Secretary to the Joint Committee of the Pudsey, Calverley, and Farsley Local Boards, convening a meeting of the Boards' representatives, to be held at Leeds, to receive and consider the reply from the Company to the Boards' joint offer, and the action now to be taken on the matter. A member asked that the Farsley representatives should be instructed how to act in the matter at the meeting. The Chairman, in reply, said the Board had passed a resolution not to advance upon their offer of £12,000; and they could not go beyond it. This was agreed to.

The Progress of the Leeds Water-Works.—On Monday last week the members of the Leeds Corporation paid their annual visit to the water-works, accompanied by the Town Clerk (Sir G. Morrison) and the Borough Engineer (Mr. Hewson). At the dinner which closed the day's proceedings, the Mayor (Mr. Cooke), who is Chairman of the Water Committee, referred to the progress of the works. He expressed the hope that what the visitors had seen that day had impressed their minds with the magnificence and solidarity of the property; for it was one of the three premier water undertakings in the kingdom, and was only rivalled, though not surpassed, by Glasgow and Manchester. The past year had been one of responsibility for the Water Committee, by reason of the difficulties connected with the contract for the Blackmoor Tunnel. After an anxious time, the contractor had had to resign; but the work was taken up by the Borough Engineer, and was rapidly progressing under his direction. The old works had performed their function smoothly and well. During last year 15 miles of new mains had been laid, and a new 30-inch main, carrying 6 million gallons of water daily, had been constructed as far as Hunslet. Farnley had received a long-needed and earnestly-desired supply; and the pumping-main to Bramley had been duplicated, with the effect of largely improving the entire district supply. The ever-growing demand would of necessity ere long bring the Committee and Corporation to practically handle the question of new filter-beds. Speaking of the financial aspect of the question, his Worship stated that the total expenses on capital account to March, 1891, amounted to £1,641,031; and the debt up to the same period was £1,535,464. The latter had been reduced by sinking-fund operations to the extent of £102,512. In addition, there had been invested in sound securities close upon £100,000, which would ultimately be applied to the reduction of the debt. As showing the growth of the water supply system, he stated that it was purchased from the Leeds Water-Works Company in 1852 for the sum of £225,730, and the gross income for the year 1853 was £14,172—the number of houses then supplied being 25,000. The gross income on revenue account for the year 1891 was £101,744—the number of houses supplied being 188,000; and the net profit for the year, after meeting expenses to the amount of £80,000, and setting aside £15,146 for payment to the sinking fund, was £6588, as against £3965 in the previous year, or an increase of £2623. In conclusion, he acknowledged the excellent services of the Borough Engineer and his staff; and said that Leeds should be justly proud of its water supply.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bill read the third time and passed: Keighley Corporation Bill.
Bills Royal Assented: Alloa Water Bill; Falmouth Water Bill.

LEGAL INTELLIGENCE.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Thursday, July 30.

(*Before Sir* P. H. EDLIN, Q.C., *Chairman, and a Bench of Magistrates.*)

The Gaslight and Coke Company's Assessment Appeals.

To-day the appeals of The Gaslight and Coke Company against their assessments in the City of London Union and various parishes, came again before the Court by arrangement.* The list contained 126 appeals in respect to parishes within the City of London Union; one each in the cases of Marylebone, St. Pancras, Bloomsbury, Shoreditch, Hampstead, Paddington, Islington, St. Saviour's Union, Chelsea, Bethnal Green, Westminster Union, and Kensington; two in regard to the Hackney and St. George's Unions; and six to the Strand Union.

Mr. LITTLER, Q.C., Mr. CASTLE, Q.C., and Mr. DANCKWERTS appeared on behalf of the appellants; the SOLICITOR-GENERAL (Sir E. Clarke, Q.C., M.P.), Mr. POLAND, Q.C., and Mr. R. C. GLEN represented the City of London Union; and among the Counsel attending on behalf of the other respondents were Mr. FULLERTON, Q.C., Mr. HOUGHTON, Mr. LYONS, Mr. ROBINS, Mr. W. RYDE, Mr. J. V. AUSTIN, Mr. BEVAN, Mr. A. H. BODKIN, Mr. HORACE AVORY, Mr. MARSHALL, Mr. BUCKMASTER, Mr. A. GLEN, Mr. GERMAINE, and Mr. J. MONTEFIORE.

Prior to the case being opened,

The CHAIRMAN said there was a preliminary question which would have to be considered—viz., as to whether there might not be an objection to his hearing the appeals, inasmuch as he was a ratepayer in the parish of Paddington and also a customer of the appellant Company; so that it might be said he was disqualified from acting judicially in the matter. The same observation would arise with regard to those Magistrates who were ratepayers and possibly consumers in one or other of the parishes in which the assessments were appealed against; but it would be for the parties to consider whether they would waive any objection that might be raised in that respect.

Mr. LITTLER, on behalf of the Company, said they absolutely waived any objection of that sort.

Other gentlemen representing the various repondents having made a similar waiver, it was agreed that the appeals should proceed on the case against the City of London Union as regards the totals; the arrangement of the distribution between the several parishes being left for subsequent action.

Mr. LITTLER then proceeded to open the case for the appellants. He said, of course, the appeals were of extreme importance pecuniarily; and there was great variance in the views which some of the opponents seemed to take, judging by their figures, with regard to the method by which the result should be arrived at. There were now before the Court 128 appeals; but he must confess that, were it not for the enormous importance of the matter to the Company, and the very large amount that depended upon the decision of the Court, he should have thought it would have been an extremely simple and quite ordinary case of an appeal by a gas company. Having regard, however, to the large number of the enemy he had to meet, and the vast importance of the result of the various aggregates of differences, it was necessary to go into the matter at greater length than he would otherwise have dreamed of doing. The Gaslight and Coke Company was, without question, the largest commercial undertaking supplying light in the whole world; and the figures were something startling. In the first place, since the re-arrangement of the Company's districts, the Company was practically responsible for the lighting, and therefore to a large extent for the safety, of nearly all the area on the north side of the Thames within the Metropolitan district, and for some parts actually beyond it. The district extended to 80 square miles; and as nearly every mile was filled with houses, it was easy to appreciate what an enormous undertaking it was, and what heavy responsibility rested upon the Directors to see that there was no failure in carrying out their statutory obligations. In those 80 square miles, there were no fewer than 1900 lineal miles of mains, apart from distributing-pipes. The Company delivered during the year a quantity of gas which one had almost to put down in figures in order to see how enormous it was; for it was actually 18,536 million cubic feet. When one came to consider what would be the result of any serious failure on the part of the Company, and the consequence, in pecuniary penalties, to them, it would be seen that it was reasonable for them to take greater precautions to ensure the absence of any possible chance of failure in the supply of gas. Having said this, he might point out the position in which they at present stood. First of all the Gas Companies in the Metropolis, as elsewhere, had a very determined foe in a quarter which many people did not quite appreciate. The greatest enemy to gas companies was not the electric light, which was a more costly and luxurious illuminant than gas—although, of course, it was not a competitor to be despised—but the humble paraffin lamp. Paraffin was sold so cheaply that it was very extensively used, more especially where gas-fittings had not been provided by the landlords in the poorer classes of houses and tenements. So strongly had this been felt, that the Company, as well as other gas companies, had adopted the plan of taking weekly payments for their gas in these cases. There was also another matter for consideration. Not only were they pressed by the exigencies of the poor, who wanted a cheap light, but unfortunately the ladies seemed to have an idea that the light given by the better class of paraffin was softer than that of gas. Anyhow, they preferred it; and the consequence was that while, on the one hand, the Company were pressed by the cheapness of paraffin in the poorer quarters, they were on the other, confronted by its more extended use in the richer quarters. In the dining-rooms and the drawing-rooms of the upper classes, especially on festive occasions, the gas chandeliers remained unlighted, and were profitless to the Company, whereas paraffin lamps were substituted, with the assistance of candles, and other artificial light, not being gas. These were matters which were of considerable importance to all gas companies; and he took it that to none were they of more moment than to The Gaslight and Coke Company, because they had an enormous district of exceedingly moderate houses, as well as a large area occupied by those of a better class. When he came to the latter, he had to remind the Court of the competition to which the Company were being subjected to a greater extent day by day by the electric light.

The CHAIRMAN: Still the accounts of the Company will, I apprehend, show the operation of the competition.

Mr. LITTLER said this was what he was coming to; and he thought that before he had reached the end of his statement, and certainly before he had gone very far into the evidence, his Worship would find that there was very great reason for affording a margin to the Company in respect to these things. But they found that, instead of allowing this margin (and he would presently have to refer to another matter which was very important, as regards labour and the cost of coal), in the City of London parishes, while the assessment in the quinquennium from 1886 to 1891 was £27,151, the Overseers began to shear the sheep slightly closer. When they came to the Overseers' figures for the new quinquennium, they increased it to the comparatively moderate amount of £29,325. The Company objected. Their view was that, so far from the £27,151 being right, £17,564 was sufficient. They desired to have a decrease instead of an increase. They invoked the aid of the Assessment Committee; but the Committee incontinently put the figures to £51,697 which sum was not very far from double that at which the Overseers had put it. It was rather interesting to see what had been done in the Metropolitan parishes. The assessment for the quinquennium up to 1891 was £347,277; but from 1891 to 1896 they increased it to £353,663. There were now 22 Metropolitan parishes in which there were appeals. Either the Company were altogether wrong in their figures, or the Court would feel that they had some ground for asking for relief; because, instead of £353,663, the Company contended that the figures should be £117,509. The Assessment Committee allowed £357,587, or £4000 more than the Overseers. He would first pause to comment on this point—that it was a singular thing that the City of London parishes should double the assessment while in -he other parishes the Assessment Commissioners put up the figures to the extent of only 3½ per cent.

The CHAIRMAN: Why should you say it is a singular thing, if they had different values?

Mr. LITTLER said that if there was any principle being adopted, which was anything like accurate, as to the totals, it was difficult to imagine that there could be such a discrepancy in finding out, as between the parishes, what their share was. Before going into the question of coal and labour, he would mention one other figure. In the parishes, not being City of London but Metropolitan parishes, where there was no appeal in the last quinquennium, they were assessed at £233,249; and these figures had now been put up to £236,257 for the new quinquennium. This was practically, though not entirely, in the parishes where the Company's works were situated. St. Pancras was the most important case, as in this there was an appeal in a parish in which there were works. The others were immaterial. Practically, therefore, the great difference between the Company and the parishes was not as to the value of the works, but as to the value of the mains; and what had to be dealt with was the question as to their being directly or indirectly productive. The works did not vary; and therefore they found those parishes in which there were works putting the figures at about what they were before.

The CHAIRMAN: But they say that your profits derived from the supply vary.

Mr. LITTLER said certainly. The last quinquennium witnessed a very important, and for gas companies a very serious, change for the worse. In the year 1889, following on the great dock strikes, came a great dislocation of labour, not only among their skilled stokers and others, but also among the coal miners and the men employed in the shipping business—the seamen and firemen employed on vessels bringing the coals from the North. One of the first things that happened was that the wages of the Company's own men had to be very largely increased. And there was a reduction to the extent of one-third in the number of hours the men were employed; so that instead of working twelve-hour shifts they only worked eight hours. But although the gas workmen desired less labour, they did not appreciate that they ought to have any reduction in the *quid pro quo*; and they insisted upon the same wages for eight hours' work as they had received for twelve.

The CHAIRMAN: It was not an increase in wages, but a decrease in the hours of labour, which would have imposed upon the Company an additional expense for production.

Mr. LITTLER said that was so; the men had the same wages, while they only did two-thirds of the work. And not only this, but, what with Union rules and other inventions for easing the lot of the poor, they managed to do considerably less work per hour in the eight hours than they did in the twelve. For instance, there was a rule about the filling of the scoops, which used to be heaped up with coal. Now they were filled straight off at the top. So that in this way the Company had suffered; and the consumers and the parishes would have to bear their share. When he told the Court that the Company paid upwards of £1,000,000 per annum in wages, they would see what this meant, and what an enormous change for the worse it made in their position. They had, it was true, raised the price of gas, but not proportionately. In addition to this, owing to the Company being one of those working under the sliding scale, for every rise in price they suffered a decrease in their dividend. The standard price was 3s. 9d. per 1000 cubic feet; and for every drop of 1d. below this, they might declare 5s. per cent. more dividend, whereas for every rise

* See JOURNAL, for June 2 last, p. 1073.

of 1d. they sacrificed this amount of dividend. It was no advantage therefore, but quite the contrary, to the Company to increase their price; and they would never do it voluntarily. The next result of the wages agitation was that the price of coal, iron, and the carriage of coal from the North, and general labour, increased. In the year ending June, 1886, which was the first year of the last quinquennium, the price of coal was 12s. 10d. per ton; in 1887, it was 12s. 3d. (leaving out decimals); in 1888, 12s. 1¼d.; in 1889, 12s. 0¾d.

The CHAIRMAN asked if he was right in saying that this amount was made up, according to the suggestion of the Court at the previous hearing, to the end of June, 1890, so that they had the last twelve months terminating at that date.

Mr. LITTLER said this was so. Now he would ask the Court to take the figure for the twelve months ending June, 1890, so as to compare it with the 12s. 0¾d. In the next twelve months it had risen to 13s. 2¾d. per ton—a rise of 1s. 2d. The Company consumed in the year nearly 2 million tons of coal. There was one other figure which was material, because he was going to put it that, as this was to be a calculation for five years, it was reasonable for the Court to hear what any prudent intending tenant, knowing the condition of the coal market and the position of the surroundings, and being a skilled person, would be likely to expect; and he would call witnesses to say that they anticipated at that time that there would be a still further rise. As a matter of fact, they found that since then there had been a most alarming rise; so that the price was 15s. 3d. per ton, taking the twelve months up to December, 1890, instead of the period to June in that year.

The CHAIRMAN asked what it would be for the consumption in the last half year only. The figures for the year ending June 30, 1890, had been stated as 13s. 2¾d. per ton; and then Mr. Littler had given the price for the year ending in December last as an average of 15s. 3d. But it occurred to him (the Chairman) that the learned Counsel might also be able to give the average price for the last six months.

Mr. LITTLER said he thought he would be able to do so; but he had not the figure before him at the moment.

The CHAIRMAN remarked that, for the purposes of his argument, Mr. Littler might possibly prefer to use that.

Mr. LITTLER said it would help his argument; but he was endeavouring, at all events, to keep within the bounds of reasonable moderation in the matters he put before the Court.

The CHAIRMAN: You are asking me to consider what a hypothetical tenant would give. Then why not say: "Look at the average of the last six months" which would be a safer criterion than the last twelve months.

Mr. LITTLER said he now had the figure asked for. The average for the half year ending December, 1890, would have been 15s. 10d. For the year just concluded, up to June, 1891, it gave an average of 16s. 1d. per ton; but for the half year ending June 30, 1891, it was 16s. 4¾d. per ton. So that it would be seen that the rise had been steady; and not only steady, but exceedingly large. If they took the year 1889, which was the lowest, they had a rise from 12s. 0¾d. to 16s. 4¾d., or more than 25 per cent., in the item of coal alone. But this was not all, because they found that a large number of the coalmasters—notably one with whom the Company had large contracts—had difficulties with their men, and they put into operation against the Company the strike clause in the contracts, which was intended for this very purpose, and the Company had to make the best arrangements they could with the various coalowners, in order to get their coals in the future even at this enhanced price. Amongst these arrangements was one that the coal should be delivered more equally throughout the year. The Directors were obliged to comply with these requirements, because it had become more than ever necessary that they should not be at the mercy of either colliers or seamen for their supply of coal. They were therefore compelled, for their own protection, to keep far larger stocks than they used to have. This involved the Company, first of all, in laying out their money sooner than they would have done; and therefore, either by adding to the floating account or in some other way, they must have something more, if the Company's view was correct, in the shape of allowance for the future. Then there was another thing that involved keeping a larger stock of coal than formerly. There was a very large increase in the demand for gas for cooking purposes; and therefore the Company required more coal in summer. The main increase, however, was owing to the other items he had mentioned. What were they to do? They had last winter a very good illustration of how they might have stood unless they had kept larger stores of coal, not only in summer, but in winter also. In these large stocks, however, there were two things to be considered. First of all, if they had a very large quantity of coal they had to stack it, and this involved the double labour of stacking and unstacking. Secondly, coal kept for any length of time was liable to generate heat; and then they did not get from it so much gas per ton as they otherwise would. There again was an element of increased cost, because a ton of stacked coal when carbonized would not yield the same quantity of gas as it would do if just brought into the works; and they could not put it fresh into the works for the reasons he had given. To show how close the Company had been run in the past winter, he would mention another thing which they had occasionally to guard against, but which possibly might not be recurring in the same shape for a long period. At the very time of the difficulties with the seamen and pitmen, and to a certain extent with their own men, a long frost occurred, and consequently a series of fogs arose; and so hardly were the Company pressed that, although they had, at the proper time in the winter, what they looked upon as a very safe margin of stock—469,000 tons of coal—they came, at the end of the period of frost and fog, within a day and a half of having no supply at all. So that, if the frost had not broken up, they would have been compelled to take steps to at once have coals run from inland by rail, at a very much higher cost. This, in itself, was an indication of how necessary it was, with so gigantic a property and so enormous a responsibility as the Company represented, to take care that in the future they were well armed, in their own works, with a sufficiency of coal for carbonizing, he would not say for an indefinite, but for a very long definite period. The result of all this had been that the increase in the cost of coal brought into the works had been £397,644 per annum. To show in another way what had been the effect on the working of the Company, he would ask his Worship to note that the gross profit for the year ending Christmas, 1889, was £971,887, while for the twelve months ending June, 1890, they came to £781,884; showing a loss of £190,000.

The CHAIRMAN said he doubted if this comparison would be of much use, because the other figures were up to the 31st of December.

Mr. LITTLER said he was now going to give the total for the year ending Dec. 31, 1890; the amount being £702,576.

The CHAIRMAN observed that comparing this with the previous twelve months, it showed a decrease of £269,311.

Mr. LITTLER agreed that this was so. He went on to say that on the 1st of July, 1890, they raised the price of gas by 3d. per 1000 cubic feet—from 2s. 6d. to 2s. 9d.—on the north side of the river only. Of the £702,576 for the year 1890, the increase in the price accounted for no less than £109,767; so that but for the rise in price the profits would only have been £392,808, or a loss of £379,000. Taking the twelve months to the 30th of June of the present year, containing a whole year at the increased price, of the £752,276 the increase in the price accounted for £220,177, which would have left, at the old rate, a gross profit of £530,099 to be compared with £971,887, or a loss of £441,788. Therefore, instead of there being such an increase as would justify the doubling of the rateable value, there had been a decrease of gross profits which would more nearly justify the halving of it, apart from other considerations which he would have to put before the Court. These two matters would, of course, very gravely affect the mind of any probable tenant, who would be taking not merely for one year, but, as Lord Esher had said, with a probable likelihood of continuance in his occupation for subsequent years. More especially in London he would look forward for the whole five years, and see what were the labour and the coal prospects during that time; and the Company's experts would tell the Court that their prognostication had been singularly confirmed by events. There was another thing of importance in these matters—viz., the condition of the works, and what would be likely to be expended on the retorts (which rather burnt out than wore out) and for ordinary repairs resulting from ordinary wear and tear. As regards the appellant Company, most of the works—notably the Beckton and other works at the East-end of London—were comparatively new; and, of course, they had not had to lay out so much upon them. The Beckton station, which produced nearly half of the total output of gas for the north side of the Thames, was only a comparatively few years old; the amount produced by these works being 46 million cubic feet out of the total of 102 millions the Company delivered to the public every day. In the matter of repairs, they adopted the course that was recognized by everybody as a sensible one, of taking an average for a number of years, so as to keep the rating and the Company's accounts reasonably equal. The Bromley works made 10 million cubic feet a day; and they were comparatively new. During the last quinquennium, materials had been extremely low in price, especially iron and fire-clay. But the latter was now much higher; and engineers' and smiths' wages, and so on, had been increasing. What the Company had done, therefore, in presenting the case to the Court, was to adopt the usual course of taking the gross amount, then the deductions for wear and tear, then the tenant's share of the capital (which would be proved at 17½ per cent.); then from this they took the landlord's gross share, then the landlord's net share in the usual way, and then the net rateable value of the whole. They then allowed, or set off, what was indirectly and what directly productive; and by this means they arrived at the total rateable value of the works. He proposed, first of all, to call Mr. Field, the Chief Accountant of the Company. Then he would call surveyors and engineers; though it seemed to him that the matter would turn very much more on the evidence of the latter than that of the former, because in this case there was no question of works, but simply of productive and unproductive mains, which would seem to fall more within the category of engineering than of surveying. When they came to ascertain what were the points that would affect the mind of a probable tenant, the principle of dealing with it would be just the ordinary one adopted in these cases.

The CHAIRMAN said he supposed the witnesses had based their figures, in accordance with the suggestion of the Court on the last occasion, so as to include the accounts up to the June of last year.

Mr. CASTLE replied that they had.

The CHAIRMAN said he presumed that the figures for the last twelve months were presented merely for the purpose of showing that the cost of labour, material, &c., was on the ascending scale, and that those who suggested it was so were more accurate than those who took into consideration the possibility of prices descending.

Mr. CASTLE said this was so, and also to rebut any presumption sought to be made from the increased price of gas. He was, however, prepared to stand absolutely on the figures of June 30, 1890.

The CHAIRMAN asked Mr. Poland if he acquiesced in this.

Mr. POLAND replied that he would prefer not to answer the question until he had consulted his leader (the Solicitor-General) on the matter.

Mr. CASTLE said that if the figures for the period ending June 30, 1890, were taken absolutely, the Company would stand by them; but if the respondents sought to alter those figures because the Company raised the price of gas on July 1, 1890, they would seek to bring in the other figures.

Mr. POLAND said that some of the valuers for the respondents undoubtedly took into consideration the fact that there would be an increase of revenue derived from the advanced price of gas.

The CHAIRMAN said Mr. Littler's figures raised this consideration He had not avoided those figures, but, on the contrary, had dealt with them.

Mr. *J. W. Field* was then called, and, in reply to Mr. CASTLE, said his method of dealing with the different expenses of the Company, and the question of capital, &c., was to bring it down to the standard of "1000 cubic feet of gas sold;" and in the account he was about to submit he had adopted this principle. The accounts he had prepared were not made out for the purposes of the present case, but were those passed by the Board of Trade Auditor. The Company's price for gas in the year ending Dec. 30, 1889, and up to June 30, 1890, was 2s. 6d. per 1000 cubic feet for common gas supplied north of the Thames;

and 2s. 3d. for that sold south of the Thames; 3s. 1d. being charged for cannel gas, which was used principally at the West-end of London. The total net receipts for the twelve months ending June 30, 1890, amounted to £2,273,180 for gas-rental. To this figure was added the rental for the use of meters and stoves, amounting to £61,791; making together £2,334,971. The revenue from the sale of residuals came to £841,754, or 11·18d. per 1000 cubic feet. Miscellaneous receipts were £1574; raising the total income to £3,178,299. The principal items of expenditure were for labour and coals; the actual cost of the latter being £1,255,316. Salaies for manufacturing came to £20,068; and those for carbonizing to £331,568. The difference between the manufacturing and carbonizing salaries was that the latter were purely for work done in the retort-house; while the former included engineers, superintendents, officers, and clerks in the office. Then there were repairs of mains, meters, and stoves; public lamp charges; management, parliamentary, and law charges; and public officers' expenses and annuities—amounting altogether to £2,239,884. The Company having been formed by the amalgamation of eight or nine other Gas Companies, they were compelled to compensate the officers of those Companies under the Schemes for Amalgamation passed by the Board of Trade; and the annuities in the accounts referred to a large extent to those officers who were surviving. They also included the means of providing for old workmen. The £2,239,884, amounting to 2s. 5·75d. per 1000 cubic feet sold, represented all the expenses of the Company for the year, except the rates, and brought down the net receipts to £938,415, or equal to 1s. 0·46d. per 1000 cubic feet. The amount deducted for rates and taxes was £162,687; but from this there was a credit of £73,887 for rents received. Then having arrived at the net receipts, he deducted the usual allowances for tenant's capital, which he took at the 17½ per cent.

Mr. LITTLER asked if the 17½ per cent. was seriously disputed.

Mr. POLAND replied that it was not a case for frivolity, but whatever was disputed, would be seriously disputed. He might say at once that the Solicitor-General did propose to ask the Court to consider and review the question of the 17½ per cent.

Examination continued: The tenant's capital, on which he calculated the 17½ per cent., was £1,705,577, which was the sum of money that a tenant would need to have in hand before he could take over a concern of this magnitude. It was made up of a cash balance of £50,000; and 450,000 tons of coal in stock, amounting to £326,250. That was calculated at 14s. 6d. per ton, which was considerably less than what it could be bought for now. For the whole year 1890, the coals cost the Company 15s. 3d. per ton; and for the current year, ending June, 1891, they cost 16s. 1d. The average price for the year ending June 30, 1890, was 13s. 2¾d.; but for the latter half of the year it was 14s. 7·37d. An incoming tenant would not only have to supply £326,250 for the stock of coal, but he would find a lot of coke and other materials on the works, which he would have to take over. He estimated that 25,000 tons of coke, amounting (at 10s. a ton) to £12,500, would have to be taken over; and the tenant would also have to provide for tar, ammoniacal liquor, and other products, £80,000, and for sundry stores—fire-bricks, clay retorts, iron, steel, sundry castings, petroleum oil, oxide of iron, meters, stoves, timber, bricks, horses, and sundries—which would represent a sum of £157,439. Then for tools and chattels, as to which Mr. Jones would speak, there would have to be provided £170,801; for meters, £275,826; and for stoves, £53,665. In addition to this, there would be five-twelfths of the net expenditure which the tenant would have to find for outgoings, until he could get back some part of his money by way of gas-rental. This would amount to £529,096. He would also have to pay the rates, which would amount to £50,000. The total capital required by the tenant was thus brought up to £1,705,577; and 17½ per cent. on this amount would be £298,477. In addition to that, he had allowed a further sum for insurance of the buildings from fire, at 10s. per cent. For renewals, he had allowed the amount of 1·63d. per 1000 cubic feet; the amount actually spent last year having been 4·37d. That gave a sum of £122,976, which, added to the insurance, made a total of £141,583; leaving as the rateable value of the whole. *plus* rates, £498,355, which in his opinion was the fair rateable valuation of the premises as a whole. The rates were calculated at 5s. 2d. in the pound, amounting to £29,363. Deducting the rates, and the indirectly productive works and mains, brought out the rateable value of the living mains at £113,667, which worked out at 4·84 per cent. upon the gas and meter rentals. In 1889, they first foresaw that they would have to pay a very large sum in excess under the head of wages. In June last year, there was an agitation among the stokers, which resulted in the reduction of the number of hours worked per day from twelve to eight; and the excess in wages which they had had to pay in consequence was £85,913, for carbonizing alone.

Mr. CASTLE: In fact, you had to pay 10·55d. per ton more for carbonizing coal than you had formerly?

Witness: Yes. There was also a large increase in other items, such as purification, maintenance, public lighting, and so forth; but in no case so large as with the stokers. On the average, it was an increase of 20 per cent. all round. With regard to the coal contracts, some years ago they made them in July and August; but of late years they had made them in April. The ruling price that they would have to pay this year was the price he had already given—14s. 6d. per ton. In 1889, though there was no strike, there was a very serious movement among the miners for increased wages, which sent up the price 3s. or 4s. a ton. The Company had to submit to some of their contracts being broken; one firm putting into operation the strike clauses. They were now required by the contractors to spread the delivery of coal over the summer almost equally with the winter; whereas formerly they took in the coal more nearly in proportion to the quantity consumed. This resulted in their having to store and stack it, and to handle it more often, which caused the coal to deteriorate; and they had to keep a larger stock all the year round, instead of the smaller stock used for consumption.

As a matter of fact, what can you say you did pay for the coal which was bought in the spring of 1890?—At first, the prices quoted in January, 1890, were 19s. per ton; while in 1889 we bought coals at 9s. 6d. per ton. But the price at which we ultimately bought in 1890 was 16s. The actual annual increase of the Company's coal bill was £311,000. The 1889 contract was an autumn contract, made in August, 1888, and deliverable between July, 1889, and June, 1890. Large quantities of coal like this have to be arranged for a considerable time before the period of delivery, as the coal-owners have to take up ships and generally to make their arrangements.

Those are the contracts which you had to break, or subject to modification?—Yes.

The CHAIRMAN: Then assume that if coals are to be delivered in December, 1890, the contract for delivery was positively made one year and six months beforehand?

Witness: Those contracts were all cancelled in the spring. They were originally made in August, 1888; and the delivery was to commence on the 1st of July, 1889, and run up to June, 1890.

Mr. CASTLE: Now can you tell me about the labour. Is this labour question the result of the organization of the Trade Union Societies?

Witness: To a great extent; the stokers were never organized into Trades Unions until quite recent years. A tenant would have no right to expect any reduction on the present increase of the labour bill, for the tendency even now is rather upwards. Every detail of the work is regulated by the Trades Unions, even to the amount that a coal-scoop is to hold. With regard to the price of coal, I anticipate a reduction from the price of 16s.; but as far as I can see, there will be no reduction from the 14s. 6d.

Have you heard that they are going up on the 1st of August?—Fortunately we have made our contracts for the twelve months, and certainly we shall not get them for a penny under the 14s. 6d.

The CHAIRMAN: I suppose there is a scale?

Witness: No, there is not. There is no official scale—no settled scale. The question of freights and the labour market up in the North all tend to govern the prices.

I suppose the 14s. 6d. includes the cost of delivery at your stacking yards, but not the cost of stacking?—It includes all the expense of stacking. Those wages are all charged to the coal account, under the direction of the Board of Trade. The price paid for the coal which we are now using is 16s. 4d. per ton.

Owing to the absence of the Solicitor-General, it was arranged that the cross-examination of Mr. Field should stand over until the following day.

The next witness was Mr. *G. F. L. Foulger*, the Company's Chief Inspector, who was examined by Mr. LITTLER; and he was under cross-examination when the Court rose.

The report of these and the further proceedings in the case will be given next week.

Gas Exhibition and Cookery Lectures at Accrington.—Last week a very successful gas exhibition was held in the Liberal Club, Accrington, under the auspices of the Accrington Gas Company. It was conducted by Messrs. Unsworth and Richmond, of Warrington. During the previous week Messrs. J. Wright and Co., Limited, were exhibiting in the same building. Alderman Heywood, Vice-Chairman of the Company, opened the exhibition, and introduced to the audience Mr. Richmond, who gave an address on "The Advantages of Gas as a Fuel." Mrs. Thwaites, of Liverpool, lectured on gas cookery daily. The exhibition was so successful, that it has been extended into the present week.

Weymouth Gas Company.—In the report which the Directors of this Company will present to the shareholders at their meeting on the 13th inst., it is stated that the business was satisfactory in the six months ending June 30 last, notwithstanding certain unfavourable circumstances which operated during this period; and the result has been the realization of an average amount of profit. There was a larger output of gas as compared with the corresponding period of last year, and consequently an increased gas-rental; and the receipts from other sources were also in excess of those for the six months ending June 30, 1890. The additional expenditure, however, was more than equal to the augmented income; so that the balance carried to the net revenue account is somewhat less. However, there is a sum of £2774 available for division; and out of this the Directors recommend the payment of a dividend for the half year at the rate of 10 per cent. per annum on the ordinary "A" stock, and of 7 per cent. per annum on the ordinary shares—both subject to deduction for income-tax.

The Proposed Re-Imposition of the London Coal Dues.—At the meeting of the London County Council last Tuesday, the General Purposes Committee reported that, on the 18th of June last, the Vestry Clerk of Kensington communicated to the Clerk of the Council two resolutions passed at a conference of delegates of Vestries and District Boards, expressing the opinion that the abolition of the coal dues had totally failed to afford the relief predicted at the time they were abolished; experience having clearly proved that not only had no gain come to the coal consumers of London, but that an appreciable increase had been caused by their abolition in the direct local taxation of the Metropolis, and a serious obstacle raised to the carrying out of important Metropolitan improvements. The conference therefore thought that the dues should be re-imposed; and that the Council and the City Corporation should be asked to co-operate in a movement having this object in view. The Committee in their reply pointed out that the Council had, in the early days of their existence, opposed a Bill to prolong the existence of the dues; and that, seeing that the levying of them had ceased by the consent of both parties in the State, there was little reason to suppose that any representations or efforts on the part of the local governing bodies of London, even if they were unanimous, would induce the Legislature to re-impose the duties as a source of municipal revenue. The Vestry Clerk, on receipt of this reply, asked if it had been sent with the cognizance of the Council. The Committee acknowledged that it had not been written by their order, but said it set forth their views and expressed their recorded opinion. When the Committee's report came before the Council last Tuesday, it was objected that so important a matter ought to have been submitted to the Council for their consideration. Eventually, a motion was proposed not to receive the paragraph relating to this matter. The voting being equal, the Chairman (Sir John Lubbock) decided to vote in favour of excluding the paragraph, so as to give the Council an opportunity of re-considering the subject.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

The London County Council and the Standard of Light.

At the Meeting of the London County Council last Tuesday, the Sanitary and Special Purposes Committee presented the following report on the subject of a proposed amendment of the law relating to testing of gas in the Metropolis :—

We have at various times reported to the Council the steps we have taken for obtaining an amendment of the law in relation to the standard of light. The Acts which regulate the gas supplied to London by the principal Gas Companies require that the illuminating power of gas shall, when consumed at the rate of 5 cubic feet per hour by means of a standard Argand gas-burner, be equal in intensity to the light given by 16 sperm candles, six to the pound, each burning at the rate of 120 grains per hour. The standard is a most unsatisfactory one, owing to the great variation that inevitably occurs in the candles themselves, and to some extent, in the method of burning them. This uncertainty has been recognized for many years past by all the authorities who are engaged in the manufacture or supervision of gas, and upwards of ten years ago the Board of Trade appointed a Committee, which reported adversely of the existing standard. Since that time many efforts have been made to obtain the substitution of a more satisfactory standard; and the Council has for the past two years been in frequent communication with the Board of Trade on the subject. At the request of that Board, the Council caused to be prepared clauses and schedules for insertion in a Bill, which we understood was to be introduced by that Board for giving effect to the Council's views. After giving these clauses very careful consideration, the Board of Trade think that the matter is one with which the Council might usefully deal, so far as the question relates to the London Gas Companies. The Board of Trade have undertaken to appoint a Scientific Committee to consider what the standard of light should be; and they ask if the Council would be prepared to bear the expense of such a Committee. We are not prepared to advise the Council to bear the cost of this Committee. In the first place, the settlement of the standard of light is an Imperial and not a local question; and, in the second, it is questionable if the Council has power to expend money for the purpose. We recommend—"That a Bill be introduced by the Council in the next session of Parliament for substituting a more exact standard of light for that now prescribed by the principal Gas Companies' Acts; and that it be referred to the Parliamentary Committee to take the necessary steps for this purpose."

The recommendation was agreed to without debate.

THE EXAMINATIONS IN GAS MANUFACTURE.

We have been favoured by the Superintendent of the Technological Examinations of the City and Guilds of London Institute (Sir Philip Magnus) with a copy of the programme of the examinations which will be conducted by the Institute in the session 1891-2, together with a list of the successful candidates in the last examinations in "Gas Manufacture," which took place towards the close of April—Mr. Charles Hunt, M. Inst. C.E., being the Examiner. The following are the names of those who passed :—

HONOURS GRADE—

First Class.—Cannold, C. A.; Glover, T.; Watson, R. (with the Salters' Company's Prize of £2, and the Institute's First Prize—a Silver Medal).

Second Class.—Clark, G. H.; Hesketh, S.; Hoare, H. (of New South Wales); Ingram, S. J.; Lee, F.; Methven, W.; Randall, W. B.; Steel, J. J. J.; White, J.

ORDINARY GRADE—

First Class.—Dry, R. A. (with the Salters' Company's Prize of £1, and the Institute's First Prize—a Silver Medal); Goodman, R.; Gracie, H. H. (with the Salters' Company's Prize of £1, and the Institute's Second Prize—a Bronze Medal); Head, H. C.; Hope, A. J.; Waddell, F.

Second Class.—Blackadder, T. T.; Booth, R.; Mackenzie, J.; M'Leod, A.; Meiklejohn, J.; Milbourne, R. J.; Morfett, J. E.; Preston, O. J.; Rogers, F.; Thomson, R. B. H.

The following were the questions put to the candidates :—

Ordinary Grade.

1. If the light given by two gas-lamps placed 70 feet apart be equal at four-fifths of the distance between them, what is the relative illuminating value of the lamps? 2. What do you understand by destructive distillation as distinguished from ordinary combustion? 3. Describe any ordinary method of jointing cast-iron distributing-mains. Give a sketch of the joint. 4. What is a Methven screen, and how is it employed? 5. What change, if any, takes place in the composition of the gaseous products on their way from the retort to the exhauster? 6. Give a description, with sketch, of the Livesey washer, and explain its use. 7. What is spent oxide? Explain how it is produced, and describe the method by which it is usually tested. 8. State what you know of the principles that should govern the construction of flat-flame and Argand gas-burners, having regard to the development of illuminating power. 9. How would you correct for temperature and barometric pressure a volume of gas which at 68° Fahr. and 30·5 inches barometer measures 1000 cubic feet? 10. What do you understand by direct firing as applied to retort furnaces?

Honours Grade.

1. Describe, with the aid of sketches, the two kinds of joint mostly used for cast-iron main-pipes, and state their relative advantages. 2. About what percentage of incombustible ash would you expect to find in the coke produced from a gas coal containing 3·5 per cent. of such ash? 3. Explain how the measurement of gas is effected by a station meter. Give a sketch of the measuring wheel. 4. Explain the difference, if any, between a station governor, a street-lamp regulator, and a consumer's gas governor. 5. What is about the usual percentage of ammonia in good commercial sulphate? and state how many pounds of such sulphate are theoretically equivalent to a yield of 35 gallons of 10-oz. liquor per ton of coal carbonized. 6. Describe a tower scrubber, and explain in what way its efficiency depends upon its dimensions and internal arrangement. 7. What would you recommend as a practical limit to (*a*) the number of retorts set in one furnace; and (*b*) the size of retort and weight of charges? Give reasons for your answer. 8. Explain briefly the difference between the ordinary, and what is known as the Gadd and Mason system of gasholder guides. State the conditions under which the ordinary guide-framing may be wholly or partially dispensed with. 9. What are the relative advantages of oxide of iron and lime as purifying agents, and how would you prepare the latter for use in the purifiers? 10. Name, in the order of their superiority, three distinct types of gas-burners in present use; and state the principles upon which each is based.

The examinations next year will include questions founded on such subjects as the following :—

Ordinary Grade.

1. The construction of a retort or oven best adapted for the destructive distillation of coal. 2. The setting of retorts and the construction of retort furnaces. 3. The effects of temperature in modifying the quantity and quality of the gas produced. 4. The description and arrangement of apparatus employed for the conveyance of the gas immediately upon its leaving the retorts. 5. The description of apparatus best adapted for condensing and cooling the gas. 6. The most suitable condition of the gas for effective purification. 7. A description of the various instruments used in gas-works for ascertaining and recording pressure and exhaust. 8. The laying of mains and service-pipes. 9. The construction of gas-meters. 10. The fixing of meters and the fitting up of premises for the supply of gas. 11. A description of the various kinds of gas-burners in general use. 12. The use of an exhauster. 13. The methods employed for controlling pressure at the works, so as to secure an adequate supply of gas at the various points of consumption, with a due regard for economical effect. 14. The simplest methods of ascertaining the purity and illuminating power of gas. 15. A description of the materials and methods employed for the purification of gas. 16. Influence of temperature and barometric pressure upon the volume of gas. 17. A description of the various tests employed for determining the values of ammoniacal liquor and spent oxide.

Honours Grade.

In the examination for honours, more difficult questions will be set in the above subjects; and, in addition, a knowledge will be required of: 1. The characteristic properties of the various kinds of coal, and their value for gas-making purposes. 2. The effects of temperature upon the production of residuals. 3. The chemical composition of coal gas. 4. The chemistry of purification. 5. Quantitative tests for impurities. 6. The development of illuminating power. 7. The practice of photometry. 8. Labour-saving appliances in the retort-house, and the working of retorts. 9. The construction of gasholders, purifiers, and other gas apparatus. 10. The working up of ammoniacal liquor. 11. The principles of combustion, and their application to the working of retort furnaces.

A provisional certificate will be granted on the results of the above examination. For the full technological certificate in the Ordinary Grade, the candidate who is not otherwise qualified will also be required to have passed the Science and Art Department's examination in the elementary stage at least, and for the full certificate in the Honours Grade in the advanced stage at least, in two of the following science subjects: Machine construction and drawing, applied mechanics, light and heat, inorganic chemistry, organic chemistry, geology, metallurgy, and steam.

Among the books of reference recommended to the candidates are "King's Treatise on Coal Gas," Newbigging's "Gas Manager's Handbook," Dibdin's "Practical Photometry," Cripps's "Guide-Framing of Gasholders," Hartley's "Gas Analyst's Manual," Wanklyn's "Gas Engineer's Chemical Manual," and Thorpe's "Quantitative Analysis."

The programme contains the rules and regulations applicable to the examinations, a syllabus of the subjects, a list of the registered teachers therein, the papers set last year, and the list of prize-winners. It may be obtained (price 8d., post free), as well as any further information, on application to the City and Guilds of London Institute, Examinations Department, Exhibition Road, London, S.W.

Albo-Carbon Light Company, Limited.—The report of the Directors of this Company, made up to the 30th of June last, states that the net balance at the credit of the profit and loss account is £1232. Out of this, the Directors have applied a further sum of £200 to the reduction of patents account, which now stands at £2600 only (having been reduced from the original figure of £7971), and a further sum of £50 in reduction of new premises account; and they now propose that a dividend of 7½ per cent. for the year, as in the two preceding years, be declared. This will absorb £873, and leave a balance of £109 to be carried forward.

Gasholder Accident at the Bristol Gas-Works.—Last Wednesday morning, an accident occurred at the Stapleton Road works of the Bristol Gas Company, which unfortunately resulted in injury to several men. One of the holders at these works has lately been having a third lift added; and, to allow of this being done, the crown had been removed, and was supported on scaffolding. This gave way; and the mass of sheet iron, 140 feet in diameter, fell into the tank. Luckily for the seven men engaged on the job, its fall was broken by the "dumpling;" and to this fact probably they owe their lives. As it was, they all sustained injuries, which in four cases were so serious as to necessitate the removal of the men to the Infirmary, after the doctors who were immediately summoned had rendered what assistance they could. The two men who were most badly hurt were detained; the others received attention from the medical staff and returned to their lodgings.

THE GASLIGHT AND COKE COMPANY.

The following reports, with the accounts showing the working of this Company during the six months ending June 30 last (given on the opposite page), will be submitted to the proprietors at the half-yearly general meeting on Friday next.

Report of the Directors.

The accounts for the half year ending on the 30th of June last are herewith submitted.

After providing for fixed charges, a balance of £195,746 6s. 10d. remains applicable to the dividend on the ordinary stock of the Company. The price of common gas being 2s. 9d. per 1000 cubic feet, the statutory dividend under the sliding scale is 13 per cent., which the Directors recommend be again declared. The reserve fund applicable to the equalization of dividends now stands at £391,914 6s. 6d. To meet the dividend, it will be necessary to withdraw from the reserve fund the sum of £159,845 5s. 2d.; leaving a balance of £232,069 1s. 4d.

In view of threatened labour difficulties in the coal districts and elsewhere, and to meet the requirements of coal-owners for a more even regulation of monthly deliveries of coal throughout the year, the Directors decided, in the summer of last year, to accumulate more than their usual winter provision of coal. Some additional expenditure in handling, as well as some deterioration of quality from exposure to weather, has of necessity resulted from storeage in the open air. But the possession of more than ordinary stocks of coal within their works placed the Directors in a strong position to meet any disturbance in the shipping trade, and enabled them to pass, without serious anxiety, through the difficulties caused by protracted frost and the prevalence of dense fog during a winter of almost unexampled severity. The coal contracts of last year, at high prices, have expired; and the Directors have concluded new contracts at a reduction of price, which will considerably lower the cost of manufacture.

There has been an increase of nearly 10 per cent. in the quantity of gas sold in the Company's district; and additions to plant are in progress to meet the demand, the growth of which appears to be to some extent attributable to daylight consumption for warming and cooking stoves, and also for mechanical motive power.

To supply the place of cannel, which has now reached such a price as to render it almost unavailable for the Company's manufacturing purposes, the Directors have adopted the use of oil in the retorts for the enrichment of the gas; and the application of the system thus far has given fair prospect of success. With the same object the Directors are utilizing some of the patents for water-gas manufacture; and they are of opinion that the advantages to be derived from these new processes, taken in connection with the reduced cost of coal, will exercise a beneficial effect upon the working of the Company.

The Company's appeal to Quarter Sessions for relief from the excessive parochial taxation proposed under the recent quinquennial re-valuation have been delayed by the pressure of business before the Court. They will shortly be heard.

The several measures which were introduced into Parliament at the commencement of the present session, affecting the Company's interests, have received the close attention of the Directors, who have been successful in obtaining ample protection for the Company.

The Directors regret to announce the death of their esteemed colleague Mr. Stephenson Clarke, whose seat at the Court has been filled by the appointment of Mr. John Birch Paddon, who will hold office as a Director until the completion of the term for which Mr. Clarke had been re-elected.

WILLIAM THOMAS MAKINS, Governor.

Horseferry Road, Westminster, S.W., July 17, 1891.

Engineer's Department.

I beg to certify that the whole of the Company's gas manufacturing and storeage stations and also distributing plant under my charge have been kept in good repair and efficiency during the past six months. The additions to the manufacturing and storeage plant at the Beckton and Kensal Green stations were somewhat retarded in their progress during the severe weather of last winter, but have since then been carried on with rapidity.

G. C. TREWBY, Engineer-in-Chief.

Distribution Department.

I hereby certify that during the past half year the whole of the distributing plant under my charge has been maintained in a thorough state of repair and efficiency, and the various pressures of gas have been well regulated.

G. F. L. FOULGER, Chief Inspector.

Products Department.

I hereby certify that the whole of the plant, engines, boilers, stills, trucks, machinery, and tools in connection with the Company's products works under my charge have during the past half year been maintained in good working order and repair.

THOS. WILTON, Superintendent of Products Works.

Following the foregoing reports is the statement of accounts. As usual, we merely indicate the alterations which have taken place in those portions which are not subject to much variation; reproducing the remainder in full.

Nos. 1 and 2 are the statements of stock, share, and loan capital, the totals of which on June 30 last were as follows: Stock and share capital, £8,579,000; loan capital, £2,444,000. The former figures are an increase of £300,000 as compared with those for Dec. 31, 1890—being the amount of additional preference stock raised during the past six months; the latter stand as before.

No. 3 is the capital account, the receipts on which now reach £11,795,400; comprising the above-named amount of share and loan capital, and £772,400 of premium capital. This is an advance of £432,900—the £300,000 of new preference capital and £132,900 of premiums received thereon. The expenditure is shown in the following items:—

Expenditure to Dec. 31, 1890			£10,633,062 6 11
Expenditure during the half year to June 30, 1891, viz.:—			
Lands acquired, including law charges	£21,669 11 11		
Buildings and machinery in extension of works	147,361 6 2		
New and additional mains and service-pipes	7,584 14 5		
Do. do. meters	1,927 14 4		
Do. do. stoves	6,936 6 6		
	£185,479 13 4		
Cr. By depreciation of meters	£4,060 0 0		
Do. do. stoves	5,863 0 0		
	9,923 0 0		
		175,556 13 4	
		£10,808,619 0 3	
Balance of capital account		986,780 19 9	
		£11,795,400 0 0	

Nos. 4 and 5 are the revenue and net revenue accounts. These are given in full on the opposite page.

No. 6 is a statement showing how the Directors propose to appropriate the balance applicable for dividend. It is as follows:—

June, 1890.				
£198,680	..	Net balance brought from last account	—	
164,303	..	Net revenue for the half year	£195,746 6 10	
—	..	Amount to be withdrawn from the reserve fund	159,845 5 2	
				£355,591 12 0
£362,983				
(13 per cent.) £355,590	..	A dividend on the ordinary stock—13 per cent. on £5,470,640	—	355,591 12 0
£7,393	..	Balance carried to next account		—

Nos. 7 and 8 are the reserve and insurance fund accounts. The former shows that the balance of the reserve fund on Dec. 31 last was £531,395 5s. 4d., which was increased at June 30 to £537,609 18s. 8d. by the addition of £6214 13s. 4d.—interest on the amount invested. The insurance fund stood at £85,962 3s. 7d. at the end of the year; on June 30 last it amounted to £87,130 9s. 10d.

No. 9 is the depreciation fund account. It stood at £38,637 16s. 2d. at the close of the past year; and on June 30 it had been raised to £39,162 18s. 9d. by the addition of £525 2s. 7d. received as interest.

Nos. 10 and 11 are as follows; and Nos. 12 and 13 are given on the opposite page.

No. 10.—STATEMENT OF COALS USED, ETC.

Description of Coal.	In Store, Dec. 31, 1890.	Received during Half Year.	Carbonized during Half Year.	Used during Half Year.	In Store, June 30, 1891.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common	345,738	915,756	1,071,559	2,095	187,840
Cannel	6,327	35,477	*28,992	—	12,812
Total	352,065	951,233	1,100,551	2,095	200,652

* In addition to cannel, 2378 tons of oil have been used.

No. 11.—STATEMENT OF RESIDUAL PRODUCTS.

Description.	In Store, Dec. 31, 1890.	Made during Half Year.	Used during Half Year.	Sold during Half Year.	In Store, June 30, 1891.
Coke—tons	34,537	674,544	182,033	486,629	40,419
Breeze—tons	8,854	72,574	24,412	47,308	9,708
Tar—gallons	884,210	11,448,750	11,757,648	21,205	554,107
Ammoniacal liquor—butts	29,210	324,436	329,855	9,072	14,719

BRENTFORD GAS COMPANY.

The report of the Directors of this Company for the half year ending June 30 last, which will be presented at the general meeting of shareholders on Friday next, states that there is a sum of £67,553 available for division. They therefore recommend the declaration of the following dividends, subject to income-tax: At the rate of 5 per cent. per annum on the 5 per cent. preference stock; at the rate of 12¼ per cent. on the consolidated stock; and at the rate of 9¼ per cent. on the new stock, 1881. The Directors mention that during the past half year the sale of gas increased in a marked manner over the quantity sold during the corresponding period of 1890; arising to a considerable extent from the severe weather experienced last winter. The sale of £46,875 of 4 per cent. perpetual debenture stock, mentioned in the last report, realized the sum of £49,814 1s. 6d. The new gasholder-tank at Southall has been successfully completed; and good progress is being made with the new gasholder required for that station. The Directors report the construction of settings of inclined retorts at Brentford and Southall, which will be completed and ready to meet the ensuing winter's demand. Important and successful results are anticipated therefrom. The whole of the Company's plant is stated to be in good order and condition. The statement of accounts accompanying the report shows that the total revenue for the half year amounted to £113,085, against £96,114 in the corresponding period of 1890. The sale of gas produced £82,421, as compared with £70,636. Stove and meter rental returned £3488; being an increase of £316. Residuals realized £27,081—an advance of £4863. The total expenditure was £86,283, as against £69,216; the balance carried to the profit and loss account being £26,801, as compared with £26,898. The accounts relating to manufacture show that 56,427 tons of coal and cannel were carbonized during the past six months, from which 583,212,000 cubic feet of gas were made, and the following residuals produced: Coke, 36,614 tons; breeze, 4625 tons; tar, 580,571 gallons; ammoniacal liquor, 16,093 butts (including 533 butts purchased). The capital account stands as follows: Total receipts to June 30 last, £789,713. Expenditure to December 31, 1890, £739,849; ditto in the half year ending June 30 last, £25,343 (of which £21,212 was for new building and machinery in extension of works)—total, £765,192; leaving a balance of £24,521.

ACCOUNTS OF THE GASLIGHT AND COKE COMPANY FOR THE HALF YEAR ENDING JUNE 30, 1891.

No. 4.—REVENUE ACCOUNT.

Dr. Cr.

June Half Year, 1890.	To Manufacture of gas—	£ s. d.	£ s. d.	June Half Year, 1890.	By Sale of gas—	£ s. d.	£ s. d.
	Coals, including oil, dues, carriage, unloading and trimming (see Account No. 10)	902,074 3 2		£1,031,619	Common gas, per meter, at 2s. 9d. and 2s. 3d. per 1000 cubic feet.	1,242,321 10 10	
£701,429	Salaries of Engineers and other Officers at works	10,199 18 2		43,991	Cannel gas, per meter, at 3s. 5d. per 1000 cubic feet	50,426 19 3	
10,115	Wages (carbonizing)	193,894 2 10		66,246	Public lighting and under contracts—		
169,558	Purification, including £19,693 14s. for labour	45,961 8 2		2,522	Common gas	68,504 15 7	
32,320	Repair and maintenance of works and plant, materials and labour, less received for old materials,			£1,144,378	Cannel gas	2,591 19 7	
	£2035 3s. 3d.	152,642 4 4		27,228	(See Statement No. 12.)		1,363,835 5 3
131,847	Distribution of gas—		1,303,671 16 8	4,882	Rental of meters	..	27,817 0 0
	Salaries and wages of Officers (including Rental Clerks)	23,869 10 8		241,225	Rental of stoves	..	7,408 16 0
24,482	Repair and maintenance of mains and service-pipes	28,753 3 6		7,404	Residual products—		
24,718	Repair and renewals of meters	17,791 18 9		109,562	Coke, less £42,030 17s. 4d. for labour, &c.	313,397 17 8	
15,342	Stove fixing, repairs, and renewals	21,734 5 11		76,755	Breeze, less £3401 14s. 3d. for ditto	7,590 16 11	
21,726	Public lamps—		92,148 18 10	3,701	Tar and tar products	121,483 15 4	
	Lighting and repairing	16,368 4 4		196	Ammoniacal liquor and sulphate of ammonia	82,667 14 10	
15,668	Experimental street lighting	164 17 9		300			525,080 4 9
141	Rents, rates, and taxes—		16,533 2 1		Rents receivable		3,981 7 0
	Rents payable	2,927 8 6			Transfer fees		227 0 0
3,393	Rates and taxes	78,140 10 6			Canteen account		300 0 0
78,598	Management—		81,067 19 0				
	Directors' allowance	2,750 0 0					
2,750	Company's Auditors	200 0 0					
200	Salaries of Secretary, Accountant, and Clerks	8,133 6 11					
7,757	Collectors' commission	14,662 16 5					
14,471	Stationery and printing	4,248 8 9					
3,697	General charges	1,913 18 11					
1,724			31,908 11 0				
	Parliamentary charges	..	1,983 19 6				
3,104	Law charges (including Surveyor's charges *re* Quinquennial Valuation)	..	1,633 5 2				
2,693	Bad debts	..	7,077 1 1				
6,791	Depreciation fund, for works on lease-hold land	..	..				
750	Annuities	..	10,047 18 1				
9,338	Public Officers—						
	Gas Referees and Official Auditor	1,120 19 10					
1,109	Public testing-stations	729 15 4	1,850 15 2				
1,214							
£1,284,935			1,547,923 6 7				
330,696	Balance carried to net revenue account, No. 5		380,726 6 5				
£1,615,631			1,928,649 18 0	£1,615,631			1,928,649 13 0

No. 5.—NET REVENUE ACCOUNT.

Dr. Cr.

June Half Year, 1890.		£ s. d.	£ s. d.	June Half Year, 1890.		£ s. d.	£ s. d.
£54,920	To Interest on debenture stocks and bonds, accrued to June 30, 1891	..	62,659 12 6	£574,785	By Balance from last account	209,895 6 10	
59,759	Dividend on the preference stocks	72,539 0 0		,,	,, Amount withdrawn from Reserve Fund	145,695 12 2	
47,500	Dividend on the maximum stocks	47,500 0 0		£76,105	Less dividend on the ordinary capital for the half year to Dec. 31, 1890.	..	355,590 19 0
			120,039 0 0				355,590 19 0
4,214	Interest on temporary loans and sundry funds		2,281 7 1	£198,680			
362,983	Balance applicable to dividend on the ordinary stock		195,746 6 10	330,696	Revenue account (No. 4)	..	380,726 6 5
£529,376			380,726 6 5	£529,376			380,726 6 5

No. 12.—STATEMENT OF GAS MADE, SOLD, Etc.

Description of Gas.	Quantity Made.	Quantity Sold.			Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lamps.
		Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity Sold.				
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	10,392,945	484,095	9,094,911	9,579,006	131,695	9,710,701	682,244	49,225
Cannel	341,202	15,942	295,182	311,124	2,591	313,715	27,487	2,182
Total	10,734,147	500,037	9,390,093	9,890,130	134,286	10,024,416	709,731	51,407
June half year, 1890	9,838,974	484,851	8,543,381	9,028,232	117,484	9,145,716	693,258	50,351

No. 13.—GENERAL BALANCE-SHEET.

Dr. Cr.

June Half Year 1890.		£ s. d.	£ s. d.	June Half Year 1890.		£ s. d.	£ s. d.
£	To Capital—			£			
249,139	Balance at credit thereof	..	986,780 19 9	53,371	By Cash at Bankers	..	186,085 11 6
	Net Revenue—			..	Amount on deposit at interest	..	350,000 0 0
332,983	Balance at credit thereof	..	195,746 6 10				
	Reserve Fund—				Amount invested—		
524,296	Balance at credit thereof	391,914 6 6			2¾ per Ct. Consolidated Stock . . £530,130 0 6	..	518,207 15 1
	Insurance Fund—			697,749			
84,814	Balance at credit thereof	87,130 9 10			Stores on hand, viz.—		
	Depreciation Fund—			203,657	Coals	168,322 5 0	
37,382	Balance at credit thereof	39,162 18 9		1,526	Coke	23,678 11 6	
			518,207 15 1		Tar and ammoniacal liquor and products	79,453 6 11	
	Interest on debenture stocks and bonds, due on June 30, 1891	..	62,659 12 6	78,993	Sundry stores	211,499 5 2	
54,920	Preference and maximum dividends due on June 30, 1891	..	120,039 0 0	157,440			482,952 8 7
107,259	Unclaimed dividends due on June 30, 1891	..	10,670 18 6		Accounts due to the Company, viz.—		
10,689	Sundry tradesmen and others, for amount due for coals, stores, and sundries	..	259,315 18 6	459,085	Gas and meter rental—		
	Benevolent Fund	..	1,667 6 8	18,801	Quarter ending June 30, 1891	544,074 0 11	
213,019					Arrears outstanding	23,165 7 11	
1,667				34,674			567,239 8 10
				872	Coke and other residual products	33,102 9 8	
					Sundry accounts	17,500 4 2	
							50,602 13 10
1,646,168			2,155,087 17 10	1,646,168			2,155,087 17 10

BIRMINGHAM CORPORATION GAS SUPPLY.

Officers' Superannuation Funds—The Paris Municipality and the Gas Undertaking.

At the Meeting of the Birmingham City Council last Tuesday—the MAYOR (Alderman Clayton) presiding—the report of the Gas Committee, which was given in the JOURNAL last week, was presented. As may be remembered, it contained revised regulations for the management of the salaried officers' and meter inspectors' superannuation funds.

Alderman POLLACK, in moving the adoption of the regulations above referred to, said that the funds in question had been in operation since January, 1887, but the new proposals were made with a view to perfecting the system. The men contributed 2½ per cent. of their salary; and the Gas Department paid a like amount, and undertook the management expenses. Contributors were entitled to superannuation allowances on reaching the age of 60 years, and after a period of service of not less than 20 years. If the members left the service of the department voluntarily, or were compelled to leave for misconduct, they lost their contributions. If, however, they retired from ill-health or from the staff being reduced, they received back the whole of the contributions they had paid in; and in the case of a member dying before he was entitled to superannuation, his relatives received the amount of his subscriptions. At the end of March last year, the fund amounted to £16,558. The Gas Committee had found the necessity for new regulations. In future it would be compulsory for all members of the staff to join the fund—though it was worthy of note that only nine of the old employés declined to do this, and they were servants of the Gas Company, and were too old to reap any pecuniary benefits from joining. It was also proposed that the officers who retired voluntarily should have one-half of their contributions refunded; while it was optional for members to contribute either 2½ or 3 per cent. of their salaries. The Committee had also considered the question of a superannuation fund for the workmen in the department; but there were too many obstacles in the way. He hoped, however, the suggested scheme of superannuation for the whole of the workmen employed by the Corporation would not be allowed to drop, but that a suitable and workable one would be devised. The difficulty in the Gas Department was that the men objected to contribute from their weekly wages. The suggestion was that they should receive 5s. per week on attaining the age of 65 years and after 30 years' work; but most of them felt they would not be in the service of the department the length of time necessary to entitle them to the benefits of the fund.

Mr. PARKER seconded the proposition, which, after a short discussion, was adopted.

Alderman POLLACK next moved the adoption of the report. He remarked that the Gas Committee were somewhat disappointed at the high price of coal; and, in addition to this, the revenue from coke was decreasing, owing to the flat state of the iron trade. He had found from experience that coke was an excellent barometer of trade; and, under the circumstances, he was afraid they would have some difficulty in making both ends meet this year. He referred with satisfaction to the results which had attended the lectures on the use of gas cooking-stoves; and he also alluded to the recent visit of a deputation from the Paris Municipal Council, who, although they had come to inspect the tramways, had manifested considerable interest in the gas undertaking, especially in reference to its transfer to the Corporation. A print of the annual report of the Gas Committee had been forwarded to them; and it had been translated into French. Further information as to the history of the acquisition of the gas-works having been requested, a copy of the second volume of Mr. Bunce's "History of Birmingham" was sent to Paris, and placed in the library of the Municipal Council.

The report was adopted.

TAUNTON GAS COMPANY.

The Effect of the Competition of Electric Lighting.

The Annual Meeting of the above-named Company was held last Tuesday, under the presidency of Dr. W. M. Kelly, Chairman of the Board. After the notice convening the meeting had been read by the Secretary and Manager (Mr. A. J. Edwards), the Chairman read the report, which was briefly alluded to in the JOURNAL last week. Commenting thereon, he remarked that it was a cause for the greatest satisfaction when they noticed the quantity of gas which had been supplied during the past twelvemonth—viz., 58,818,200 cubic feet. In the preceding year they sent out 55,906,000 cubic feet; and therefore the increase had been nearly 3,000,000 cubic feet. He found that in 1884 the quantity was 48,875,000 cubic feet; so that within a few feet they had actually risen to the extent of 10,000,000 cubic feet during the past seven years. This was much more than he had anticipated; and he was sure it must be most gratifying to the Directors, and equally so to the shareholders. He had made inquiries as to how the increase of last year occurred. They must remember that they lost some custom by the introduction of the electric light; but although they had to compete with this, yet of the 3,000,000 increase, 550,000 cubic feet had been taken by new customers. This was very satisfactory, as showing that additional houses were being built. The remainder—nearly 2,500,000 cubic feet—had arisen partly, perhaps, owing to the past severe winter, but also to the increased trade of the town. A large portion was due to the fact that the manufacturers had required more light in consequence of working later hours. An extra quantity of gas had been used at the railway station; and a great deal had been consumed at the electric light works, where it was employed to drive gas-engines. It was pleasing to find the Company's product could be used for this purpose. Looking at the balance-sheet, they found there had been an increase of £41 from the public lamps, and £741 from private customers; while on account of coke and sulphate of ammonia, there was an advance of £447. This, of course, had necessitated greater expenditure; and £206 more had been paid in wages than in the previous year. For repairs there was also an advance. The profits of the year were amply sufficient to warrant the declaration of the statutory dividends. The report was adopted. The three retiring Directors and the Auditor having been re-elected, the Chairman proposed a vote of thanks to Mr. Edwards and the staff and workmen. He remarked that they had all worked in a most efficient manner—a fact which was especially gratifying when so much was heard of strikes. The Company gave a bonus to the labourers; and the adoption of this plan had been attended by considerable success. Mr. Edwards had to work excessively hard during the winter; and they all appreciated the way in which he conducted the works. The motion having been carried, Mr. Edwards replied on behalf of himself and the staff; saying he had received the most cordial support from the officers and men. The meeting then terminated.

BOLTON CORPORATION GAS AND WATER SUPPLY.

The Annual Accounts.

The Borough Treasurer of Bolton (Mr. G. Swainson) has issued his abstract of the accounts of the Corporation for the year 1890-91, from which we extract the following statistics relating to the Gas and Water Departments:—

In the year 1890-91 the sales of gas amounted to £94,279, as against £83,504 in 1889-90, and £77,616 in 1888-89; the gratifying growth in this direction observable last year being more than maintained. The old deposit account, which possibly did much in the past to keep down the number of small consumers, has been further reduced by £424; leaving £872 still in hand. Residual products realized £27,955, as against £23,540 in 1889-90. Meter-rental brought in £2750, as against £2384; but there was a slight decline in the profits from the fitting trade, which stand at £1185, against £1273. The income from other sources reached £28,773; the total income being £126,989. Against this the manufacture of gas cost £64,338, against £50,493; and distribution, £3985, against £2635. In management expenses there was a slight decline; this year's figures being £1901, against £2111 last year. The gas profits were £54,173; the figures for the previous five years being as follows: 1890, £52,645; 1889, £47,925; 1888, £47,374; 1887, £36,939; and 1886, £33,916. This year's profit was distributed as follows: Gas annuities, £14,460; interest on loans, &c., £6569; sinking fund, £1377, against £1392 last year; reserve fund, £13,765, this item last year being £15,940; and in aid of rates, £18,000. The amounts handed over during the previous five years were: 1890, £13,500; 1889, £12,000; 1888, £11,500; 1887, £10,809; and 1886, £5398; the total since 1873, when the gas-works were transferred to the Corporation, being £168,689. The rate per cent. per annum of gross profit on the total capital was £10 12s. 3d., against £10 6s. 3d. last year, and £8 18s. 3d. in 1888-9. As to the working, 73,532 tons of coal and cannel were carbonized; this being an increase of 3400 tons on the previous year. The average cost per ton was 11s. 7¾d., as against 9s. 4d. last year, and 8s. 7d. the year before. The total quantity of gas made was 723,590,000 cubic feet, against 689,215,000 cubic feet in 1889-90. Of this only 3·15 per cent. was lost; this being the lowest record in the borough. The bad debts only equalled 0·03d. per 1000 cubic feet sold, which is practically equivalent to the lowest point yet reached.

With regard to the Water Department, the water-rental reached £50,795, as against £48,422 last year, and £48,668 in 1888-89. The total quantity of water used through meters during the year was 720,596,000 gallons, as against 659,292,000 gallons during the preceding twelve months. The total income of the department was £52,452, against £50,052 last year. On the expenditure side there is nothing worthy of note in the ordinary items; but a sum of £2233 has been laid out on mains, £520 on the Sharpless tunnel, £651 on the Heaton tunnel, £11,832 on the High Rid reservoir, and £888 on the Heaton filter-beds. The gross profits amounted to £42,417; this item for the previous five years being: £40,859 in 1890, £37,873 in 1889, £38,853 in 1888, £23,399 in 1887, and £31,687 in 1886. Dividends and interest on loans take £24,174; and after allowances to the sinking fund (£4067) and the renewal fund (£2500), both items being larger than previous years, £11,675 is handed over to the rates. This sum has only been reached once in previous years—viz., in 1890, when the figure was £12,000, as against £9000 in the previous year. As in the Gas Department, it is interesting to note that the rate per cent. per annum of gross profit on the capital was £5 13s. 2d., as against £5 11s. 7d.; the rate per cent. per annum of net profit employed in aid of the rates being £1 11s. 2d., against £1 12s. 9d., in 1889-90. This figure is the highest ever reached.

GERMAN CONTINENTAL GAS COMPANY.

Thirty-Sixth Annual Report of the Directors.

The following is an abstract translation of the report of the Directors of the above Company for the past year:—

The year 1890 commenced with very favourable prospects for an increase in the gas production; nevertheless, owing to commercial depression in the chief centres served by the Company, and also in Warsaw, the average improvement only amounted to 4·62 per cent., as compared with 6·07 per cent. in 1889. The past year was, moreover, signalized by an exceptionally high rate for coal, which was only partially recompensed by the amounts obtained for coke and tar, because the price of another residual—ammonia—had suffered a further fall. Nevertheless, the total financial result of the year is not remarkably behind the very favourable one of the previous twelve months. This is attributed, on the one hand, to improved working conditions in many of the Company's stations; and, on the other hand, to the considerable increase in the profit from the rouble exchange. Thanks to the progress of the electric light, the demand for more powerful sources of illumination becomes more and more prominent. This applies not only to large lamps of the regenerative type, but also to batswing and Argand burners, which are now found to yield insufficient light with the consumption of gas hitherto general, although the illuminating power of the gas is higher than it used to be. The employment of gas for heating and power made last year an agreeable continuous progress everywhere, even in Warsaw and Lemberg; and

the numerous and varied inquiries and orders received at the Company's central factory at Dessau indicate the manifold uses to which gas can be applied, not alone in the kitchen and household, but also in industrial establishments. The Company have sought unremittingly to encourage the introduction of gas for heating and the production of motive power, not only by the manufacture of suitable appliances, but also by reducing the cost of installations to the consumers. The construction of large gas-engines has commenced successfully. During the past year this work extended to the production of twin motors of 140-horse power, built in England on the "Otto" system; whereas during the erection of the Company's electrical station at Dessau, in 1886, the largest gas-engines known were twin motors of 60-horse power, and gas motors of 100-horse power, with four cylinders, were introduced for the first time in 1889. All experience and theoretical considerations up to the present justify the assumption that the sphere of usefulness of gas-engines is by no means limited to small motors; but that, in fact, it will continually extend in the direction of power producers of greater magnitude, inasmuch as, under such circumstances, there is simultaneously a substantial reduction in the consumption of gas per horse power. This progress in the construction of gas-engines is, moreover, of importance for the production of electric light in large centres; since even at the present time the Company are in a position, by means of a single 140-horse power twin engine in conjunction with adequate accumulators, to feed 4000 incandescent lamps burning simultaneously, which corresponds to an installation of 5000 lamps. Three such motors placed side by side, like steam-engines are at the present time, could keep going an installation of 15,000 16-candle power glow lamps, which would be sufficiently extensive for very many towns. But then all predictions indicate that the construction of gas-engines will not remain long at 140-horse power; and the combination of electrical concerns with the present gas institutions, besides showing a reduced cost of management, offers, when compared with a steam-engine installation, the advantage that the supply station may be placed in the very centre of a town, in the heart of the electric light system, which moreover would diminish the cost of cable laying without fear of trouble from smoke or explosions, with smaller requirements as regards ground, and consequently lower rent. The competition of the electric light has, up to the present time, not impeded anywhere, within the range of the Company's activity, the natural increment in the output of gas; in fact, the latter, as formerly, is influenced primarily by the commercial position of industrial matters and general business activity. The competition of petroleum was less prominent in the past year, and was effectively combatted in every place by a plentiful distribution of regenerative burners.

The business records of the Company show that the total production of gas in 1890 (amounting to 33,448,272 cubic metres, with 320,616 lights) was distributed among the various stations in the manner indicated in the following table:—

Station.	Production in Cubic Metres.		Number of Lights.	
	1890.	Increase compared with 1889.	1890.	Increase compared with 1889.
Frankfort-on-the-Oder	1,806,640	50,880	18,981	207
Potsdam-Neuendorf	2,479,732	163,418	26,480	2,011
Dessau	1,573,010	145,785	19,522	1,696
Luckenwalde	769,615	22,584	8,603	844
M. Gladbach-Rheydt-Odenkirchen	4,671,360	90,310	59,747	5,026
Hagen-Herdecke-Haspe	1,029,310	162,060	9,577	1,156
Warschau-Praga	13,889,520	297,456	107,316	605
Erfurt	2,781,454	218,492	24,483	1,564
Nordhausen	950,347	47,139	12,770	515
Lemberg	1,101,380	107,630	10,956	787
Gotha	1,044,694	42,667	13,858	533
Ruhrort	1,149,900	56,630	7,664	629
Herbesthal	213,310	70,800	599	20
Total	33,448,272	1,475,851	320,616	15,593

The total gas consumption of 33,448,272 cubic metres is accounted for in the following table:—

Purpose.	Cubic Metres.	Percentage of Total Production.	Compared with 1889.
Street lighting	5,937,224	17·76	+ 193,796
Public buildings	2,496,751	7·46	+ 206,282
Private consumption	12,161,715	36·36	+ 654,423
Consumed in factories	7,848,017	23·46	+ 53,737
For heat	1,361,345	4·07	+ 200,239
For power	1,840,383	5·50	+ 256,506
Consumed by the Company	329,928	0·99	+ 22,779
Loss	1,472,909	4·40	− 111,311
Total	33,448,272	100·00	1,475,851

The average consumption of gas per burner for the past year was: For private lights, 86 cubic metres, compared with 85·8 cubic metres in the previous year; for street lights, 448·6 cubic metres, compared with 446·2 cubic metres. The average for all lights was the same as the previous year—viz., 101·4 cubic metres. The consumption of gas for power in 1890 was distributed to 468 engines, of a total of 1761½-horse power, consuming 1,840,383 cubic metres of gas. In 1880 these numbers were 116 engines, representing 240-horse power, consuming 193,557 cubic metres of gas. The length of mains in 1890 amounted to 644,142 metres, as compared with 624,424 metres in 1889.

The large store of coal in the hands of the Company prevented any derangement of their business by the deficiency in the waggon accommodation of the coal suppliers. The average price of the coal (Westphalian, English, Silesian, &c.) carbonized for gas making at the Company's stations last year was 1·68 marks per hectolitre; while the 1889 price was 1·45 marks. This rise (irrespective of the larger consumption of coal demanded by the increased production of gas) caused an expenditure of 329,734·27 marks more than in the previous year. Moreover, the Westphalian coal, notwithstanding its higher cost, was of inferior quality, especially in regard to the illuminating power of the gas produced from it; and therefore a considerable additional expenditure was incurred in the purchase of better coal (cannel and Pilsener coal) to supplement it. The yield of gas remained the same as in the previous year—viz., 23·7 cubic metres per hectolitre The fuel account amounted to 15·39 kilos. of coke and tar per 100 kilos. of coal carbonized, as compared with 15·46 kilos. in 1889. The price of coke showed an average rise from 86 to 97 pf. per hectolitre; and tar, from 2·37 to 2·73 marks per centner; whereas the price of ammonia fell, owing to competition.

The statistics relating to the different stations of the Company show that all of them augmented their production of gas, as well as recording increments in the number of lights. The largest proportional increase was at the Hagen-Herdecke-Haspe station; the increase being 18·69 per cent. on the previous year's production, and 13·73 per cent. on the number of lights. The growth of the gas supply from this station has within the past three years made the Company attain a supply approximating to that which they had immediately before the opening of the competing municipal gas-works in 1888. The reduction in the consumption of gas at the Hagen Railway Station since the 1st of January will therefore presumedly soon again be counterbalanced; and, in fact, the sale of gas at a better price will help this. But the success of the Company was considerably prejudiced by the assessment for the communal rates, about which contradictory decisions have been expressed by the higher administrative body, which will necessitate an appeal to the Superior Courts. The lowest proportional advance is recorded from the Warsaw Praga station, with 2·19 per cent. increase of production, and only 0·57 per cent. lights above the number for 1889. This is wholly attributed to the bad state of commerce and industry. Intermediate between these come the stations at Frankfort-on-the-Oder, Potsdam-Neuendorf, Luckenwalde, Minchen-Gladbach-Rheydt-Odenkirchen, Nordhausen, Lemberg, Gotha, Herbesthal, and Ruhrort. At the last station, Herr F. Hannibal was appointed Manager in place of Herr Wagner, who was transferred to the Dessau station, where the production was 10 per cent., and the number of lights 9·51 per cent., more than in the previous year; while the electrical department showed, in comparison with 1889, the following increments: Production in ampere-hours, 33·754, or 10 per cent.; number of arc lights, 5, or 9·26 per cent.; number of incandescent lamps, 141, or 4·61 per cent. The total illuminating power of these additions, reduced to 16 candles, was 124, or 3·46 per cent. The completion of the new battery of accumulators mentioned in last year's report has increased the supplying capacity as well as diminished the working expenses of this station; so that the average consumption of gas per horse power was 0·750 cubic metre, as compared with 0·953 cubic metre in 1889. The average efficiency of these accumulators for the year amounted to 78·9 per cent.—highly satisfactory figures when one takes into consideration how very unfavourable the extremely small summer demand is for the utilization of the accumulators. The financial results of this station—opened Sept. 13, 1886, and, next to that in Berlin, the oldest central station in Germany—were for the first time to a certain extent gratifying; for, though the average age of the lamps for the year was only 180 instead of 500 hours, and their profitableness depends on their hour-burning capacity, there has been some recompense in improvements in the construction of motors, dynamos, &c., and in the general accessories of such an installation. The central factory at Dessau has been enlarged by the addition of a new three-storeyed building, to provide accommodation for coping with the growing demand for all kinds of gas appliances; and if, as the Directors conclude, this tends to the development of an extensive business, an adjoining piece of land will be required for further extensions and storeage spaces, and then the central factory will be connected by a narrow-gauge line with the goods railway station. The lists of sales show, among other things, the satisfactory result that the sale of gas-stoves, particularly those suitable for large households, restaurants, hotels, &c., has much increased—a proof that in many places gas is now cheap enough even for extensive cooking arrangements. Moreover, the important inquiries for large independent heating-stoves show, contrary to expectation, that heating by gas presents so many advantages, not only as an auxiliary, but as an independent source of heat, that the price of gas is no longer the sole consideration which leads to its adoption for this purpose. The Company therefore intend to produce new and larger gas-stoves during the present year. At Erfurt, where the Company have another electrical station, the lighting of the Town Hall by electric light resulted last year in a loss of 3090·72 marks, as compared with a deficit of 3106·11 marks in the previous year. At the gas department of this station, the new establishment mentioned in the previous year's report was officially opened on the 8th of November last. The advantage of its improved working could therefore not come into operation during the past year. The increase in production at this station amounted to 218,492 cubic metres, or 8·52 per cent. of the previous year's production; while the number of lights increased by 1564, or 6·82 per cent. The amount expended on construction work at all the stations during 1889 was 959,442·18 marks.

The Company's operations at their thirteen gas-making stations, the central electrical station, and the central factory at Dessau, resulted, as shown by the profit and loss account, in a profit of 2,556,582·42 marks, which is only 52,549·02 marks less than that of the very favourable working the previous year. As already noted, the high price of coal necessitated a large additional expenditure, amounting to 329,734·27 marks. This sum does not include the outlay for the extra coal needed for the increased quantity of gas manufactured. The receipts for residual products did not cover this extra expenditure, for reasons already given; and the causes of the financial results not being seriously affected are the improvement in manufacturing methods and appliances and the high rate of exchange. The Directors, seeing how serious would be the effect of a simultaneous rise in the price of coal and fall in the value of the rouble, have started a compensation fund, with a first instalment of 200,000 marks, so as to ensure a regular dividend even under so adverse a combination of circumstances. They have also set aside the usual 10 per cent. of the profit for the special reserve fund, and 75,000 marks for the renewal fund; declaring a dividend of 10 per cent., and carrying

13,677·99 marks to the new account. The funds of the Company (exclusive of the Lemberg sinking fund of 608,494·30 marks) were therefore as follows at the beginning of the current year:—

	Marks.
Reserve fund account	1,500,000·00
Special reserve fund account	716,600·21
Renewal fund account	361,089·49
Compensation account	200,000·00
Insurance account	154,271·23
Total	2,931,960·93

The Chief Engineer—Herr O. Mohr—who had been in the Company's service since its commencement in 1856, withdrew from active work during the past year. The General-Director is Herr W. von Oechelhaeuser.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

At the Meeting of the London County Council last Tuesday, the subject of the position of the Council in regard to the water supply of the Metropolis was introduced just before the close of the sitting. The report presented by the Water Committee contained a recommendation that, with the view of securing, if possible, the passing of the Council's Water Bill this session, Sir John Lubbock should be requested to modify it in the direction of limiting it to the provision of £10,000 for carrying out the inquiries and negotiations authorized by the General Powers Act, 1890. On the report coming up,

The VICE-CHAIRMAN (Sir T. Farrer) remarked that, after what the Chairman had stated on the previous Friday as to the fate of the Water Bill as reported in the JOURNAL last week), the recommendation in the report was useless and unnecessary, and therefore he would withdraw it. He then continued: The Water Committee are proceeding vigorously with their inquiry concerning a new supply of water; and if they need more money than they have now power to spend—which amounts to nearly £2000—they will not fail to bring the matter to the notice of the Council. It would be premature, until the evidence is published, to speak fully of the report of the Select Committee, or of the results of the past session. But one or two points may now be noticed. Two steps have been gained. First, the notion of a new municipal body for the special purpose of water supply has been disposed of. Secondly, the Council and the City Corporation have been brought to act in concert in this matter; and they will, I hope and believe, continue to do so. Another point has been brought out strongly in the proceedings before the Select Committee—viz., the importance and the difficulties of dealing with the wants of the growing districts outside the municipal area, from which much of our present supply comes. Beyond these points, I fear that little has been effected by the action either of the Government or of Parliament. It will be remembered that at the end of last year the Council applied to the Government to take immediate steps on the all-important question of a new supply. The Council have received no answer to that application beyond a mere acknowledgment; and the Select Committee on the Bills of the session was appointed so late that they refused to entertain this question. Their report charges the Council with the responsibility of this and of other inquiries; but it leaves the Council hampered in making them by all the difficulties by which they have been hitherto beset. The report even aggravates these difficulties by anticipating a conclusion with respect to the purchase of the Companies. It is, however, now more than ever the duty of the Council to prosecute these inquiries; and I trust that they will do so efficiently and effectively in the best interests of London, unhampered by the report of the Select Committee, and without any foregone conclusion either as to purchase or otherwise. The first and most important of these inquiries relates to the need of a new source of supply; and this inquiry is rendered urgent by the fact that Birmingham is prepared to go to Parliament next year with a scheme for appropriating one of the best sources of supply—viz., one in Mid-Wales. It is needless to point out how undesirable it is that there should be a scramble between Birmingham and London for water. If a new supply is needed, is it to be a competing supply? On this question much interest is felt. First of all I would point out that a new supply is not necessarily a competing supply, even in the hands of the Council. As regards competition with the Companies, no person in his senses would advise competition, with all its extravagant outlay, if it can be avoided. But there may be circumstances under which competition may be necessary in order to avoid still greater extravagance; and I would strongly advise the Council to keep this weapon in reserve. At the same time, there is one thing which, in the opinion of both the Parliamentary Committee and the Water Committee, ought to be insisted on as a *sine quâ non*—viz., that if the new supply is found to be necessary, the cost of that supply shall come, so far as possible, out of the rates which the Companies are empowered to levy, or, in other words, that the inhabitants of London shall not first be called on to pay compensation to the Companies as if no new supply had to be provided, and then be called upon in addition to pay the cost of a new supply. Finally, the Council should be alive to the fact that they are entering on a very long, difficult, and important business, for the due performance of which they will have to provide most carefully. On the part of the Water Committee, I have only to add that the Committee are giving their best attention to the matter, and will keep the Council fully informed from time to time as to the results of their labours.

Mr. HUNTER said he regarded the London Water Supply as a national question; and he could not agree with the recommendations of the Select Committee of the House of Commons. Looking at the enormous population of England and the limited sources of supply, the Government ought to appoint a Royal Commission to inquire into the whole question. It was not a matter which ought to be left to any Council, however great.

The VICE-CHAIRMAN said he was very much of Mr. Hunter's opinion; but whether the course he recommended was taken or not, it was equally incumbent upon them to pursue their inquiry, because they should have to put it before any Royal Commision.

It was resolved that the observations of the Vice-Chairman should be printed and circulated, and taken into consideration at the first meeting of the Council after the recess.

NOTES FROM SCOTLAND.

From our Edinburgh Correspondent.

EDINBURGH, *Saturday*.

At their monthly meeting on Monday, the Edinburgh and Leith Gas Commissioners did not overburden themselves with work. The principal item of business before them was the approval and adoption of the accounts for the year ending May 15 last; and they only spent a few minutes over the proceedings. The Clerk read a certificate by Mr. Wodrow Thomson, the Auditor, declaring that he had found the accounts to be correct; and then Bailie Archibald moved their approval. He said he thought that, on the whole, the accounts were satisfactory. They had had an increase in their consumption of something like 100 million cubic feet. In ordinary circumstances, had the price of coal been reasonable, and had there been no strike or other extra expenditure, they would have had a large profit. As it was, they might fairly say they had supplied gas at cost price; because, with the exception of some £340, they were just about the same as when they started. At the present time the price of first-class coal was much higher than when the Commissioners entered into the contracts; and there was very little prospect of that class of coal being cheaper. It was getting scarcer every day; and what with English and foreign demand—he supposed to compete with the electric light—there was little likelihood of its getting cheaper for some time. Having raised the price of gas to 4s. 6d. per 1000 cubic feet, he thought they would have a surplus at the end of the year. Mr. Kinloch Anderson, who is developing into one of the most prominent members of the Commission, seconded; and the accounts were approved. It is to be hoped that this year will give the Commissioners some help in consolidating their position, as they had exceedingly hard lines last year, and only with difficulty kept their feet. Another subject was before them, which shows best in a light reflected from last year's proceedings—viz., the borrowing of money. It was proposed by Mr. Colston that they should remit to the Finance Committee to consider as to borrowing money on mortgage. Lord Provost Boyd expressed a doubt whether, under the Act of Parliament, a Committee could consider a question of this sort; and Bailie Archibald thought that they should delay such a question, because it was desirable they should reduce the sums already borrowed. Last year they paid £600 or £700 to the bank for overdrafts; and it was a pity they should have to borrow more money. With gas at 4s. 6d. per 1000 cubic feet, they should have a handsome profit at the end of the year; and he thought they should aim at having a surplus in hand. With Mr. Colston's consent, it was agreed to remit the subject to the Finance Committee to consider, but without powers.

The Corporation of Edinburgh have now obtained the Royal Assent to their Electric Lighting Provisional Order. In the Act confirming it, which is known as the Electric Lighting Orders Confirmation (No. 6) Act, 1891, Edinburgh and Paisley were bracketed together. At Tuesday's meeting of the Town Council, Mr. Auldjo Jamieson asked what they were to do with it—a very pertinent question, which was more easily asked than answered. I am afraid the Corporation will have difficulty in giving Mr. Jamieson a reply. Since Tuesday, the Committee which was in charge of the Order while it was in Parliament, sat to consider what they were to do, and came to the conclusion that in procuring the Order they had exhausted their duties; and that they could only report the matter to the Council, and wait for further instructions. This does not look as if there was much eagerness to take up electric lighting; and I believe this to be the fact. Had it not been to keep out speculative companies, the Provisional Order would never have been heard of. Mr. Jamieson's question must, however, be answered; and it will be interesting to watch how the Corporation set about the carrying out of the very unwelcome task which has been thrust upon them by the Order.

Mr. A. Smith, of Aberdeen, though a most intelligent and capable gas manager, is, for some reason which does not appear on the surface, made [the object of unseemly, and what might almost be described as wanton attacks by local lights of the Socialist persuasion. I have before dealt with the subject; but this week it has taken a fresh departure. A favourite method with many who wish to depreciate public servants is to hold them up to ridicule, or, if that sublimity cannot be reached, to scorn, in the public prints. That is how several onslaughts have already been made upon Mr. Smith. This week a text, or pretext for letter-writing, has been found in a remark by Mr. Smith at the meeting of the North British Association of Gas Managers in Edinburgh last week. Mr. Smith was reported to have said, on the question of stoking and coal-breaking machinery, that he had reduced the cost per ton of coal from 2s. 7d. to 1s. 6d. per ton. A Socialist has rushed into print to show that at the Town Council meeting the figures of Bailie M'Kenzie, the Convener of the Gas Committee, were that the charge had been reduced from 3s. 9¾d. to 2s. 11¼d. per ton of coal carbonized. Another writer, apparently not a Socialist, followed with certain comparisons, very forcibly expressed, between Aberdeen and Dundee, to the disadvantage of Aberdeen. The burden of his complaint was that, whereas in Aberdeen the price of coal had advanced by 10 per cent., in Dundee it was 5 per cent. under last year's figure. I do not profess to answer these things. Your readers are all sufficiently intelligent to understand how such a difference might occur. The only reason for bringing the subject into my Notes, is that these letters have had the effect of drawing Bailie M'Kenzie, who has replied—a not very safe proceeding usually, for a man in his position—that the discrepancy between the two sets of figures lay in his giving the cost of gas on delivery to the gasholder, whereas Mr. Smith only gave the cost in the retort-house. Were the matter to end here, no harm would be done; but I am afraid that Bailie M'Kenzie's letter will lead to further recriminations on the part of Mr. Smith's detractors. It is evident to everyone who desires to look at the question fairly, that the Aberdeen Gas-Works are as well managed as any in Scotland; and this being so, I think it is a pity that these Socialist agitators, who like nothing better than notoriety, should have their wish gratified. If ever one should be inclined to "rather bear the ills they have, than fly to others they know not of," it is when those ills are attempted to be inflicted upon them by those whom nobody cares for. Silent contempt is the best treatment for them.

The Edinburgh and District Water Trust met on Thursday, and approved of the accounts of the Trust for the past year. Mr. Colston, in submitting them, said he thought they showed the financial position of the Trust to be very satisfactory. The estimated expenditure for the year was £83,895. and the actual expenditure was £83,669; while the estimated revenue was £82,953, and the actual revenue was £86,101. The Trustees last year reduced the domestic water-rate from 6½d. to 6d. within the compulsory area, and from 9½ to 9d. outside that area; but notwithstanding this reduction, which amounted to about £2500, the revenue from the water-rates showed an increase over the previous year of £601. There had been an increase in the amount of water sold by meter and from special rates over last year, of £2059; of which sum £1721 was due to supplies for trade, manufactures, shipping, &c. The surplus revenue for the year was therefore £2773.

From our Glasgow Correspondent.

GLASGOW, *Saturday*.

My first bit of news in this week's "Notes," is the announcement that the Glasgow Corporation Gas Committee have resolved on making a recommendation to the Town Council at their next meeting that the price of gas for the year 1891-92 be continued at 2s. 6d. per 1000 cubic feet, which is the rate that has been charged during the past two years. That also applies to the districts that have hitherto been served by the Partick, Hillhead, and Maryhill Gas Company, and to the southern suburbs, where the Pollokshaws Gas Company have had things all their own way, as well as to those districts where they have had to compete with the Glasgow Gas Commissioners, and therefore to sell on the same terms. The fact that the price of gas is to be continued at 2s. 6d. per 1000 feet says very much for the financial and professional skill with which the great concern has been managed, alike at the City Chambers and at the several works owned by the Gas Commissioners.

As previously mentioned, the cost of the coals purchased, and to be purchased, will show a decided increase on that of any previous year; but it will not prove to be so great as in those places where the companies or corporations use cannel coal of such a quality that they may be able to supply gas having an illuminating power of 25, 27, or even 28 candles. It is really in the case of the cannels that the rates have been raised to what may be called "ransom" prices. There are other extraordinary expenses that have to be met out of the revenue for the current year, one item of which will probably amount to something like £7000, for the repair or reconstruction of the exploded holders at the Dawsholm gas-works. Bearing these various circumstances in mind, the Gas Commissioners, and the consumers generally, will have much reason to feel pleased that the price of gas is not to be advanced at this time—even to the extent of a single copper; while many of the Pollokshaws consumers will be able to congratulate themselves on the fact that, owing to the purchase of the local Company's undertaking by the Glasgow Gas Commissioners, they will henceforth get their gas at a considerably reduced rate.

I have just been informed that the case of Crawford *v.* The Glasgow Corporation Gas Commissioners, concluding for damages for deficient supply of gas for a gas-engine at the time of the dense fog last November, and which was decided against the pursuer, by Sheriff Murray, on the preliminary pleas stated by Mr. Bowers for the Gas Commissioners, has been appealed to the Sheriff-Principal. It is difficult to see what the grounds are for an appeal to the head of the Glasgow Law Courts; but, of course, in the proverbial "uncertainty of the law" there is just a chance that Sheriff Murray's decision may be overturned.

Another bit of news is the resolution of the Glasgow Corporation Gas Committee to proceed with all possible speed to increase the gas storeage power by the erection of a very large additional holder. The intention, I believe, is to erect it on the ground that was acquired several years since by the Partick, Hillhead, and Maryhill Gas Company, and which is, in a sense, only a stonesthrow from the Dawsholm works. Acting on the advice of Mr. Foulis, the Works Sub-Committee have, I am told, agreed to sanction a holder having a capacity of some 5 million cubic feet, or more than three times the capacity of each of the three-lift holders that were rendered *hors de combat* last January.

Apropos of the paper read at the annual meeting of the North British Association of Gas Managers at Edinburgh last week by Mr. J. West, of Manchester, and the discussion that took place upon it, I may mention that four retort stoking machines of the "Foulis" type have just been made in Glasgow for despatch to the Birmingham Corporation Gas-Works. Machines of the same kind are now "installed," and in daily use at the Dawsholm, Dalmarnock, and Tradeston works of the Glasgow Gas Commissioners.

The half-yearly general meeting of the Coatbridge Gas Company was held on Tuesday—Mr. David Bird in the chair. Mr. Thomas Wilson, the Manager and Secretary, submitted the report of the Directors for the past half year. It stated that the affairs of the Company continued to be in a prosperous condition. There was a total income of £6638, and the profits amounted to £1757, which, with the balance of £1648 brought from the preceding half year, made up a total of £3405 applicable for dividends. The unaccounted-for gas was at the rate of 16·63 per cent., which is not at all surprising, considering the fact that the district of supply is very extensively undermined by coal and ironstone workings carried on over the major portion of the past century. It includes the mineral workings for the famous Gartsherrie, Summerlee, Calder, and Langloan Iron-Works. The report stated that the average illuminating power of the gas supplied during the half year had been 26·58 standard candles. The works and mains had been extended during the half year at a cost of £300; and £36 had been expended on meters placed in new properties. Both amounts had been charged to works account. On the motion of the Chairman, it was resolved to pay the maximum dividends of 10 and 7 per cent. per annum on the old and new stocks, respectively. For gas sold—27,695,000 cubic feet—there had been derived a sum of £5191. A small portion was sold at 3s. 4d. per 1000 feet; and the remainder at the advanced price of 3s. 9d. For gas supplied to the public lamps, the income amounted to £273; and the meter and stove rents realized £215 Tar, naphtha, and sulphate of ammonia brought in £766. The value of the works, mains, and meters, &c., is set down at £45,665; and in addition, there are the sulphate works and plant, tar works, house property, &c.

On Tuesday of this week, Bailie Shearer, Treasurer Innes, and Councillor Lang, accompanied by Mr. John Chalmers, Secretary to the Greenock Gas Trust, visited the Corporation Gas-Works at Inchgreen, for the annual inspection, and found everything in excellent order. The new gasholder which is now in course of erection was also inspected; and the Committee expressed themselves as much satisfied with the way in which the work of their contract is being done by Messrs. Hanna, Donald, and Wilson.

The following advertisement, barring the blanks, which are mine, appeared in no fewer than four consecutive issues of a local newspaper towards the end of the past month: "Clerk and Accountant wanted by the———Gas Company. Salary £13 yearly. Applications to be sent to Mr.———, ———, ———, before the 29th current." No further comment is necessary. I may add, however, that the place where this £13-a-year "clerk and accountant" is to discharge his duties is within a few miles of Glasgow, and that in this city it is the custom to begin with, at least, £10 a year as the pay of the youngest office boy entering a commercial establishment fresh from school, and to pay him with £15 and £20 respectively in his second and third years.

Gas manufacturers have often said of late that the greatest competitor that they have to contend with is not the electric light but mineral oil; and there is much room to fear that in the coming winter the competition on the part of that lighting agent will be decidedly keener than at any former time, more especially as the price of gas has been advanced so very generally all over the country. The Scotch oil companies, through their leading representatives, endeavoured to renew the bond that existed during the past four years in respect of the wholesale prices at which their burning oil should be sold. Two meetings were held for the purpose of arriving at a common understanding; but they both broke up without any appearance of a friendly resolution being come to. It cannot be said yet that the policy to be acted on is to be one of "war to the knife;" but within the past few days it has transpired that a number of the oil companies have begun to enter into contracts for burning oil for the season at a reduction of ⅜d. per gallon on last year's prices, with a possibility of further reductions. It will thus be seen that cheap oil is to be the order of the day; consequently dear gas may suffer in the competition.

This has been another idle week in the Glasgow pig iron markets, and Scotch warrants have only fluctuated in price between 47s. 6d. and 47s. 1½d. per ton; the closing quotation yesterday afternoon being 47s. 1d. cash. In hematite and Cleveland warrants the fluctuations have been between 50s. 3½d. and 49s. 3d. per ton for the former, and 40s. 1½d. and 40s. 6d. per ton for the latter—the closing prices yesterday afternoon being, respectively, 40s. 2d. and 40s. 3d. cash per ton. It is said that there has been a shade more business done during the week in pig iron for shipment; but the volume of business is not large, and the prices of makers' iron are rather easier. There are now 73 blast furnaces in actual operation in Scotland, as against 80 at this time last year.

The Glasgow coal trade has improved to some extent during the week. Most of the collieries are well engaged in making up the leeway of the holidays. Some considerable orders are now being wiped off. Buyers have been more inclined to meet sellers, but the advances conceded have been very small. The home demand is only fair; but for export the inquiry is expanding.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 1.

Sulphate of Ammonia.—The market is gradually getting stronger; and there is a further small advance—to-day's quotation being £10 15s. Hull and Liverpool. There are numerous buyers for August-September delivery; but the purchases are principally made by dealers, while Continental buyers seem rather inclined to retire, in proportion to the improvement in the market. The quantities available are, of course, very small; and any large demand would necessarily bring about a sharp advance. There is a considerable speculative movement for future delivery; and a somewhat considerable business appears to have been done for October-March delivery at full prices. The nitrate market is inclined to be firmer; but very little is doing.

LONDON, *Aug.* 1.

Tar Products.—There is no great change to chronicle in any of these; and with the exception of carbolic and solvent naphtha, they are all steady. Benzols, if anything, are better; and business at 4s. 1d. for 90's, and 2s. 10d. for 50's, has been done during the week. There is some activity in anthracene; but prices have not altered. Pitch also is in good demand, both for prompt and forward delivery. To-day's prices are: Tar, 23s. 6d. to 29s. Pitch, 34s. 6d. Benzol, 90 per cent., 4s. 1d.; 50 per cent., 2s. 10d. Toluol, 1s. 7½d. Solvent naphtha, 1s. 3d. Crude naphtha, 1s. 2d. Creosote, 1¾d. Carbolic crystals, 6d.; crude, 60's, 1s. 3d. Cresol, 8d. Anthracene, "A" quality (nominal), 1s. 4d.; "B" quality, 10½d. to 11d.

Sulphate of Ammonia.—There has been a slight improvement in this during the week; and £10 15s. is about to-day's price for country makes. Gas liquor is selling at from 4s. to 5s.

Revolt of Gas Consumers in Lisbon.—Owing to a decision come to by the Directors of the Lisbon Gas Companies to raise the price 45 reis per cubic metre (equal to about 6d. per 1000 cubic feet), a number of shopkeepers, by way of protest, resolved to close their places of business early last Saturday. This resolution was also carried out on the following day; and during the evening people collected in front of those shops which remained open, and loudly called upon the tradesmen to put their shutters up. The police thereupon intervened, and made some arrests; the parties being transferred either to war vessels in the harbour, or to the fortress at the mouth of the port—a precaution which evoked some comment. It is stated that the Companies have decided to revert to their former scale of charges; and consequently no further demonstrations are anticipated.

THE LANCASHIRE GAS COAL TRADE.

From Our Own Correspondent.

The only special matter to notice this week in connection with the gas coal trade of this district is that rumours of another scandal in connection with the letting of the Salford Corporation coal contracts have recently been current. With regard to the prices, &c., at which these contracts have been placed, I gave full details in my report a week or two back. Since they were settled, rumours have been afloat of attempts on the part of a merchant, seeking to secure a portion of the supplies, offering inducements to the Gas Engineer and Manager (Mr. S. Y. Shoubridge), which were regarded in the light of a bribe. Naturally the Salford Corporation are specially anxious to avoid coming again into the notoriety which followed upon the Hunter revelations; and this is leading to stringent measures which possibly might otherwise not have been thought absolutely necessary. In fact, I understand that, although notice was taken of the matter when the contracts were let, there was not at the time any intention of proceeding to extreme measures; this having practically been forced upon the Corporation by complaints which were made by the contractor implicated, and which necessarily led to the re-opening of the whole question. He, on his part, maintains that the act was not intended as a bribe in any way to the Gas Manager, with the view of securing favourable consideration for his tender, and that he had no idea whatever of exercising undue or improper influence in order to secure contracts by illegitimate means. The Gas Committee of the Corporation, however, very properly felt that they were bound to relieve themselves of all responsibility in the matter; and they are now insisting, as far as they are in a position to do so, upon an inquiry being instituted which will positively settle the question which has arisen. They are proceeding under the provisions of the Act of Parliament which was passed after the revelations in connection with the Hunter scandal—the Public Bodies Corrupt Practices Act, 1889; and a deputation has already had an interview with the Attorney-General (Sir R. E. Webster, Q.C., M.P.), with the object of ascertaining if there is sufficient ground for proceedings to be taken against the contractor implicated in the present scandal. The whole matter at present lies at the discretion of the Attorney-General, who, it is stated, has before him the opinion of the Counsel consulted by the Corporation; and if he consents to issue his fiat, the matter will probably come up for public inquiry in the course of a few days. Should he, however, consider that there is no case upon which proceedings can be instituted, the Committee, in order to satisfy public opinion, will in all probability lay the whole of the correspondence before the Council at their next meeting, and leave them to take whatever course may be desirable. Certainly, it would be more satisfactory if the matter (which may possibly turn out to have been altogether misunderstood as far as both parties are concerned) can be fully inquired into; and it is unfortunate that any question of the kind should so soon have arisen in connection with the contracts of the Salford Corporation.

With regard to the general condition of the coal trade throughout the Lancashire district, a fairly steady tone is being maintained as to prices for all descriptions of round coal. The better qualities especially are maintaining list rates; the only exceptions being where buyers are prepared to take extra quantities for prompt delivery. But even on sales of this description, there are not very many colliery proprietors who are willing to offer any appreciable concession. In some cases they are preferring to put down any surplus supplies upon the pit bank, as stocks are still considerably below the average for the season of the year, and the miners are, as a rule, only working indifferently. The best qualities of Wigan Arley are quoted at 12s. to 12s. 6d. per ton; second qualities, 10s. 6d. to 11s.; Pemberton four-feet, 9s. 6d. to 10s.; and common house-fire coals, 9s. to 9s. 6d. In the lower descriptions of round coal, the market has been rather weakened by the lessening activity in some of the principal coal-using industries; but there is no very great giving way so far as inland sales are concerned—any lower prices that are quoted being chiefly upon quantities for shipment. At the pit's mouth, ordinary descriptions of steam coal average about 7s. 9d. to 8s. 3d. per ton; but for delivery at the High Level, Liverpool, or the Garston Docks, steam coals can be bought without difficulty at 9s. to 9s. 3d. per ton, with the better qualities obtainable at about 9s. 9d. to 10s. Engine classes of fuel continue to be the chief difficulty with colliery proprietors; and supplies of these are so plentiful in the market, not only from local collieries but from outside districts, that prices have to be accepted which have no relation whatever to list rates. The better qualities are fairly steady—burgy averaging 6s. 9d. to 7s. 3d. per ton; and the best qualities of slack, 6s. to 6s. 6d. But common sorts of slack may be bought at almost any figure; 3s. 6d. to 4s. per ton being about the average prices now current in the market.

Northern Coal Trade.—There has been a stronger demand for coal, both steam and gas kinds; but some of the other classes, such as bunker coal, find only a dull market. Best Northumbrian steam coal is in very full inquiry for export, at from 12s. 3d. to 12s. 6d. per ton, free on board. The collieries are producing largely; and the output is well taken up. For gas coals there is now an increasing demand, both for local consumption and for export. The price is steady for best Durham qualities, at from 9s. 6d. to 10s. per ton, free on board. Corporations and gas companies are now coming into the market with contracts, including Tynemouth, which needs some 20,000 tons. There is much more gas coal being sent to London by sea, and the quantity must be expected to be increased weekly for some few months. Bunker coal is dull; but there is rather a better demand for coal for manufacturing purposes. Smithy coal sells freely at good prices. In coke, there is still weakness; but the price has not been altered from 16s. per ton, free on board. At West Hartlepool, there have been sales at 11s. per ton, free on board. Gas coke is unaltered.

Admiralty Contract for Asbestos Goods.—The United Asbestos Company, Limited, have for the seventh time secured the contracts for the supply of all kinds of asbestos goods required for use in the Royal Navy during the ensuing twelve months.

The Price of Gas in Liverpool.—The Watch Committee of the Liverpool Corporation have expressed surprise that the Liverpool Gas Company should have raised the price of gas, which is now, they say, higher than it is in places similarly situated. Having, through the Town Clerk, addressed the Company on the subject, the Treasurer (Mr. J. F. Robinson) has informed them that the increase from 2s. 8d. to 3s. per 1000 cubic feet has been chiefly caused by the enhanced value of coal and cannel (especially the latter), and also by advance in firemen's wages. He points out that the Chairman of the Company has on more than one occasion intimated to the public that it was inevitable that at no distant date a "material increase in the price of gas" would take place; therefore, he cannot understand why the Committee should be surprised, seeing that timely warning was given of the action that the Company have now been reluctantly compelled to take. The reply is regarded as unsatisfactory.

The Willenhall Local Board and the Gas Question.—At the meeting of the Willenhall Local Board last Thursday, Mr. James proposed the appointment of a Committee of the Board, to be called the Gas Committee, to consider the present lighting contract between the Willenhall Gas Company and the Board, and thoroughly investigate the price of gas charged to the Board and private consumers. He said the gas question ought to be approached on business lines; and the Committee he proposed would have to consider whether or not the Board were being as well treated as their neighbours. The opinion was that they were paying a considerably higher price than others; and the Committee would see if they could induce the Company to meet the town and Board by reducing it. Mr. Trubshaw seconded the motion. Mr. Knowles, in supporting it, stated that the Wednesbury and Darlaston townships were being supplied with gas to the public lamps by the Birmingham Corporation at the rate of 1s. 1d. per 1000 cubic feet, which was about one-third of the price Willenhall was paying. Large gas undertakings surrounded them; and he thought they could obtain gas at a great deal less than they were paying now. Willenhall's gas bill was about £6000 per annum. If they could get the gas for £2000, and purchase the gas-works by an annual payment of another £2000, they would still have £2000 left to pay for distribution and profit. The motion was carried unanimously, and a Committee of six appointed.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 202.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	17—18	..	5 16 8
100,000	10	,,	7½	Do. 7 p. c	10	11½—12½	..	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	104-106	..	4 14 2
100,000	20	28 May	8	Bahia, Limited	20	14—16	−1	10 0 0
200,000	5	13 May	7½	Bombay, Limited	5	6½—7	..	5 7 1
40,000	5	,,	7½	Do. New	4	4¾—5¼	..	5 14 1
380,000	Stck.	26 Feb.	12½	Brentford Consolidated	100	220—225	..	5 8 10
125,000	,,	,,	9½	Do. New	100	160—164	..	5 12 10
220,000	20	12 Mar	11½	Brighton & Hove Original	20	40—42	..	5 9 6
320,000	20	10 Apl.	11½	British	20	4¼—46	+1	4 17 10
50,000	10	12 Mar.	11	Bromley, Ordinary 10 p. c.	10	18—20	..	5 10 0
39,000	10	,,	8	Do. 7 p. c.	10	13—15	..	5 6 8
328,750	10	13 Nov.	6	Buenos Ayres (New) Limited	10	7¾—8¼	..	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	90—95	−2	6 6 4
150,000	20	26 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	255—265	..	5 3 9
130,000	,,	,,	10½	Do. New do.	100	190—200	..	5 7 6
130,000	,,	26 June	4½	Do. 4½ p. c. Deb. do.	100	119—124	..	3 12 7
800,000	Stck.	11 June	10	Continental Union, Limited	100	230—240	..	4 3 4
200,000	,,	,,	7	Do. 7 p. c. Pref	100	190—200	..	3 10 0
75,000	Stck.	25 Mar.	10	Crystal Palace District	100	200—205	..	4 17 7
486,090	10	15 July	10	European, Limited	10	20—21*	..	4 15 3
354,060	10	,,	10	Do. Partly paid	7½	14½-15½*	..	4 16 9
5,470,640	Stck.	12 Feb.	13	Gaslight & Coke, A, Ordinary	100	239—244	−1	5 6 6
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	96—99	..	4 0 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	258—263	+2	3 16 1
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	120—125	..	4 0 0
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	175—180	..	4 3 4
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	162—166	..	4 4 4
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	254—259	..	3 17 3
476,000	,,	,,	—	Do. K, 6 p. c. Prf.	100	155—160	..	3 15 0
1,061,150	,,	11 June	4	Do. 4 p. c. Deb. Stk.	100	112-115	..	3 9 7
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	120-125	..	3 12 4
908,000	,,	,,	6	Do. 6 p. c. do	100	163—168	..	3 11 5
3,800,000	Stck.	13 May.	12	Imperial Continental	100	228-233	+3	5 3 0
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4¼—4¾	−⅛	6 6 4
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	100	111—113	..	4 8 6
541,920	20	11 June	6½	Monte Video, Limited	20	15—17	−1½	7 12 11
150,000	5	28 May	10	Oriental, Limited	5	8—8½	−¼	5 17 8
60,000	5	25 Mar.	7	Ottoman, Limited	5	4¼—5¼	..	6 7 3
166,870	10	26 Feb.	2	Pará Limited	10	2¼—3¼	−¼	—
420,000	100	4 May	6	People's Gas of Chicago—1st Mtg. Bds.	100	92—97	..	6 3 9
500,000	100	1 June	16	2nd Do.	100	90—95	..	6 6 4
150,000	10	28 Apl.	10	San Paulo, Limited	10	13—15	−½	6 13 4
500,000	Stck.	26 Feb	15½	South Metropolitan, A Stock	100	285—290	..	5 6 11
1,350,000	,,	,,	12	Do. B do.	100	243—248	..	4 16 9
166,500	,,	,,	13	Do. C do.	100	242—250	..	5 4 0
678,000	,,	26 June	5	Do. 5 p. c. Deb. Stk.	100	139-143	..	3 10 0
60,000	5	12 Mar.	11½	Tottenham & Edm'nton, Orig.	5	11—13	..	4 8 5
						*Ex div.		
				WATER COMPANIES.				
729,281	Stck.	26 June	10	Chelsea, Ordinary	100	260—265	..	3 15 6
1,720,560	Stck.	10 Apl.	8	East London, Ordinary	100	210—215	−1	3 14 5
544,440	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	138—143	..	3 3 0
700,000	50	11 June	8	Grand Junction	50	107—111	..	3 12 0
708,000	Stck.	12 Feb.	10½	Kent	100	265—270	..	3 17 10
1,043,800	100	26 June	9½	Lambeth, 10 p. c. max.	100	233—238	..	3 19 10
406,200	100	,,	7½	Do. 7½ p. c. max.	100	192—197	..	3 16 2
260,000	Stck.	25 Mar.	4	Do. 4 p. c. Deb. Stk.	100	118—123	..	3 5 0
500,000	100	12 Feb.	13½	New River, New Shares	100	347—352	..	3 8 10
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk	100	123-126*	..	3 3 6
902,300	Stck.	11 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	165—170	..	3 16 5
126,500	100	,,	6½	Do. 7½ p. c. do.	100	160—165	..	3 18 9
1,155,066	Stck.	11 June	10	West Middlesex	100	250—255	−2½	3 18 5

New Joint-Stock Companies.—The Gas Oil Syndicate, Limited, has been registered with a capital of £20,000, in £1 shares, to carry on generally the business of makers and suppliers of gas, and to deal in coal, coke, &c. The Water-Meter and General Trading Syndicate, Limited, has been formed with a capital of £15,000 in £1 shares, to carry on, either as principals or agents, "any business usually undertaken by capitalists and financiers."

Cambridge Gaslight Company.—The ordinary half-yearly general meeting of this Company was held last Thursday, under the presidency of Mr. C. Balls. The report presented by the Directors contained a recommendation that dividends at the rates of 10 and 7 per cent. per annum should be declared on the different classes of stock. The Manager (Mr. W. Duesbury) reported that the increase in the consumption of gas had been larger than usual, mainly owing to the severe winter. During the past half year the Directors decided to let out cooking stoves on hire; and 48 were fixed. The Chairman, in moving the adoption of the report, gave some particulars as to the progress of the undertaking, and also as to the electric lighting scheme which has been projected for the city. Notice of these matters is deferred till next week. The report was adopted; and the dividends recommended were declared.

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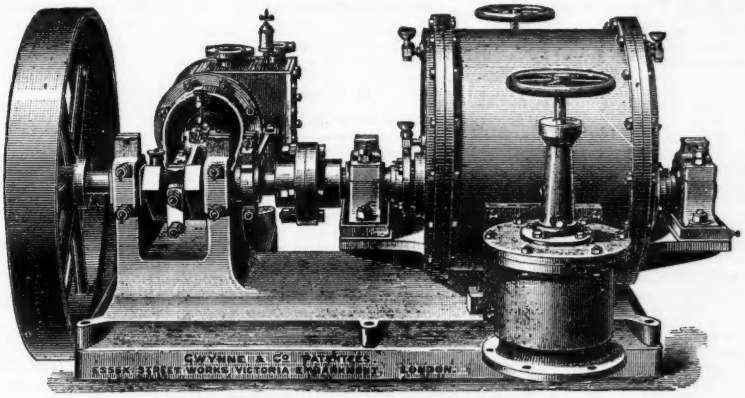

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For further information, apply to JOHN GIBSON, Town Clerk, Kirkcudbright, with whom applications, with copies of testimonials, are to be lodged on or before the 18th of August, 1891.

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THE above Company require the services of a CLERK as Bookkeeper, Timekeeper, and Collector. Salary to commence with, 25s. per week. Security to be given for £100. Duties to commence not later than the 7th of September next.
Applications to be sent in on or before the 4th of August next, with not more than three recent testimonials, and marked "Clerkship," and addressed to JOHN H. BLAND, Secretary, NUNEATON.
July 31, 1891.

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THE Town Council of Huddersfield are prepared to receive applications for the office of ASSISTANT GAS-WORKS MANAGER.
Salary, £300 a year.
A statement of the duties and conditions of appointment may be obtained from me on and after the 6th of August next.
Applications, in candidate's own handwriting, accompanied by not more than three testimonials (copies only), and written on paper of foolscap size, should be addressed to me, endorsed "Assistant Gas Manager," and must be delivered not later than Saturday, the 29th of August, 1891.
By order,
H. BARBER,
Town Clerk.
Town Hall, Huddersfield,
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Applicants must possess a clear, sound knowledge of all routine work; be able to control and direct men; and be experienced in all Retort-House Work and Main and Service laying.
Preference will be given to a man able to execute Repairs and Renewals to Retort Benches.
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Apply to Mr. W. WHATMOUGH, Gas-Works, HEYWOOD.

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A LARGE quantity of Bog Ore for Sale, delivered at Dublin or any English Port.
THOMAS E. POTTERTON, Baskinagh House, Athboy, Co. MEATH.

HARTLEPOOL GAS AND WATER COMPANY.

TO GASHOLDER MAKERS.

THE Directors of the above Company are prepared to receive TENDERS for the several Works and Materials required in the construction and erection of a GASHOLDER, 150 feet in diameter and 30 feet deep, together with STANDARDS, GIRDERS, TIE RODS, &c., connected therewith, and the fitting and completion of the same at their Works at West Hartlepool.
Plans and specification may be seen, or any further information obtained, on application to the Company's Engineer, Mr. Thomas Bower, who, if desired, will supply copies of the plans and specification.
Tenders, on form prescribed, sealed, and endorsed "Tender for Gasholder," to be sent to Mr. Thomas Trewhitt, Secretary, Gas and Water Company, West Hartlepool, not later than Wednesday, the 2nd day of September next.
The Directors do not bind themselves to accept the lowest or any tender.
By order,
THOMAS TREWHITT,
Secretary.
Gas and Water Company's Offices,
West Hartlepool, Aug. 1, 1891.

MEIKLEJOHN'S PATENT IMPROVED SLIDE-VALVE ANTI-DIP.

DURING the illness of Mr. Neill Meiklejohn, Sole Patentee and Manufacturer of the above, all communications should be addressed to C. MEIKLEJOHN, Gas Engineer, OLDBURY.

FRIEDRICH LUX, Ludwigshafen am Rhein; and at No. 142, Great Portland Street, London, W.
LUX's Gas Regulators for every consumption.
LUX's single-stem Pressure-Gauges.
LUX's Regulator for Gas-Engines.
LUX's Gas-Balance.
LUX's new Gas Regulator for Inverted Lamps; and other Apparatus for Gas Lighting, &c.

TAR AND LIQUOR.

THE Eccleshill and Bolton Gas Company invite TENDERS for the surplus TAR and AMMONIACAL LIQUOR to be produced at their Works, together or separately, for twelve months, from the 1st of September next. Can be delivered in Contractors' Tanks at the Station (G.N.R.).
Coal carbonized per annum, about 1800 tons.
Tenders, sealed and endorsed, must reach me not later than Friday, the 7th of August.
J. MELLOR,
Secretary.
Eccleshill, Bradford,
July 28, 1891.

TAR.

THE Directors of the Cheltenham Gas- light and Coke Company, are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Gas-Works during Twelve months from the 1st of October next.
Particulars may be obtained from the undersigned, to whom tenders must be sent on or before the 6th of August next.
The Directors do not bind themselves to accept the highest or any tender.
R. O. PATERSON,
Engineer.
Gas-Works, Cheltenham,
July 18, 1891.

LEIGH LOCAL BOARD.

THE Gas Committee of the Leigh Local Board invite TENDERS for the purchase of the surplus TAR produced at their Gas-Works for a period of One year from the 1st of September next.
All particulars, with form of tender, may be had from the undersigned.
Sealed tenders, endorsed "Tar," and addressed to Mr. Alderman Thorp, Chairman, to be delivered at the Town Hall, Leigh, on or before Monday, the 17th of August next.
The highest or any tender not necessarily accepted.
ALFRED T. FLETCHER,
Engineer and Manager.
Gas-Works, Leigh, Lancashire,
July 25, 1891.

TO CONTRACTORS.

THE Market Harborough Gas Company invite TENDERS for
2000 Tons of Screened GAS COAL.
100 Tons of LIME.
26 Tons of SULPHURIC ACID.
The Coal must be sent in monthly and as directed by the Manager, Mr. Armitage, of whom any further information may be obtained.
Tenders, giving price per ton at Market Harborough Station, to be sent to Wm. Gilbert, Esq., Northampton Road, Market Harborough, by the 10th of August next.
The lowest or any tender not necessarily accepted.
CHAS. BURGOINE,
Clerk.
July 25, 1891.

PATENT SULPHATE OF AMMONIA PLANT.

C. & W. WALKER.

PATENT MURIATE OF AMMONIA PLANT.
PATENT LIQUID AMMONIA PLANT.
PATENT TAR PLANT.

Makers of the most perfect form of Apparatus for the Manufacture of Sulphate, Muriate, Liquid Ammonia and Tar Products.

Apparatus already erected have proved more economical in consumption of Fuel, Simplicity, and Cheapness of Working than any known Plant.

Sole Makers of Claus' Patent

SULPHUR RECOVERY PLANT

for recovering Sulphur from Waste Gases containing Sulphuretted Hydrogen.

Testimonials & Estimates on Application.

8, FINSBURY CIRCUS, LONDON, E.C.; MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

BOROUGH OF DEWSBURY.

THE Gas Committee of the above Corporation invite TENDERS for the supply and delivery, during the Twelve months ending the 31st day of August, 1892, of:

1. SULPHURIC ACID.
2. WET AND DRY GAS-METERS.
3. CAST-IRON GAS AND WATER PIPES.

Specifications and forms of tender may be obtained on application to the Gas Engineer, Mr. Chas. A. Craven, Gas-Works, Savile Town, Dewsbury.

Tenders, under sealed covers, endorsed "Sulphuric Acid," "Meters," or "Cast-Iron Pipes" as the case may be, to be sent to me not later than Saturday, the 8th of August.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
E. MAWDESLEY,
Town Clerk.

Town Hall, Dewsbury,
August, 1891.

WEST MALLING GAS COMPANY.

TENDER FOR GAS COAL.

TENDERS are invited for the supply of about 500 tons (more or less) of Pelton Main or any other class of really good GAS COAL, to be delivered at the Company's Works, West Malling, between the 29th day of September, 1891, and the 30th day of June, 1892, in quantities of not more than 50 tons a month.

The name and quality of the Coal to be specified in the tender.

Terms, payments quarterly.

Sealed tenders, endorsed "Tender for Coal," to be forwarded to the Secretary by the 13th day of August next.

The Directors do not pledge themselves to accept the lowest or any tender.

By order,
HENRY D. WILDES,
Secretary.

West Malling, July 22, 1891.

NEWTOWNARDS TOWN COMMISSIONERS.

THE Newtownards Town Commissioners are prepared to receive TENDERS for the following, to be erected at their Works:—

One SINGLE GASHOLDER, 48 ft. 6 in. diameter, 12 feet deep.

Also two 12 feet square PURIFIERS, with valves and connections.

Tracings of plans and copies of specifications, with particulars, may be obtained on application to the Manager, Alexander Waddell, on payment of One Guinea, which will be returned on receipt of a *bonâ fide* tender.

The Commissioners do not bind themselves to accept the lowest or any tender.

Tenders, sealed, and endorsed "Gasholder," and addressed Thomas Mayne, Esq., Chairman, will be received by me up to Friday, the 7th of August.

WILLIAM HERON,
Town Clerk.

Newtownards, July 25, 1891.

MIDDLETON AND DINSDALE GAS-WORKS.

TO BE SOLD, on Thursday, the 6th of August, in the Darlington Auction Hall, Northumberland Street, Darlington, at 3.30 p.m. prompt, all those GAS-WORKS known as the Middleton and Dinsdale Gas-Works, situate at Fighting Cocks, adjoining the Line of the North-Eastern Railway Company, and which will be sold as a going concern.

The Works stand on ½ acre of land, or thereabouts, and include Retort-House, with Three Retorts, which may be increased to Five without any additional building, Purifying-House, Lime-Shed, Meter-House with Meter and Pressure Regulator fixed therein, Smith's Forge, and Manager's Dwelling-House, Garden, &c. The fixed plant will be sold with the Works, and includes the Retorts above-mentioned, Condensers, Scrubber, Lime Purifiers, and Two Gasometers, having a capacity respectively of 21,000 and 10,000 cubic feet, the Meter and Pressure Regulator, Weighing Machine, and Tar Boiler, and all Pipes and Connections from the Retorts to Condensers, Purifiers, Gasometers, &c. Also the Piping laid down for the supply of Gas to consumers, including ½ mile of 6-inch Main Pipes, 1¼ mile of 4-inch ditto, and 200 yards of 2-inch ditto, 32 Street Lamps, and 50, or thereabouts, fixed Meters in consumers' houses. The loose Tools, including Smith's and Forge Tools, and 22, or thereabouts, unfixed Meters, Consumers' Current Accounts incurred since July 1, and Gas in Holders, shall be taken at a valuation to be made in the usual way. The capacity of the Plant and Works, as they at present stand, is about Two Million cubic feet per annum.

Further particulars may be obtained on application to
EDWARD WOOLER,
Solicitor.

36, Priestgate, Darlington.

NORTH OF IRELAND

ASSOCIATION of GAS MANAGERS

THE

ANNUAL MEETING

Of this Association

WILL BE HELD IN THE

TOWN HALL, BELFAST,

ON TUESDAY, AUG. 11, 1891.

The Chair to be taken at 11.30 a.m. by the President, Mr. R. ROSS, of Dungannon.

The business will consist of the President's Address and three Papers; and arrangements will be made for a visit to the Belfast Gas-Works, to inspect the Claus Purification Plant.

The Members will dine together in the CASTLE RESTAURANT, QUEEN'S ARCADE, at Four p.m. Tickets, 4s. each, to be had from the Secretary. *It is important* that Dinner Tickets should be secured *not later than the 8th of August.*

The cordial co-operation of all Irish Gas Managers is earnestly requested by the Committee; and the Secretary will be glad to receive the names of any gentlemen intending to be present or to join the Association.

JAMES WHIMSTER,
Hon. Secretary.

Gas-Works, Armagh, July 24, 1891.

LEAFLETS for Distribution by Gas Companies and Corporation Gas Committees:—

OIL OR GAS FOR LIGHTING OUR HOMES? Price (delivered free) 5s. per 100; £2 per 1000. Larger quantities by agreement. Specimen copy, by post, 1½d.

THE COMPOSITION AND USE OF GAS LIME IN AGRICULTURE. By (the late) Dr. A. VOELCKER, Professor of Chemistry to the Royal Agricultural Society of England. Price 5s. per 100, post free.

THE VALUE OF SULPHATE OF AMMONIA AS A MANURE. By F. J. LLOYD, F.C.S., Consulting Chemist to the British Dairy Farmers Association, Lecturer on Agriculture at King's College, &c. Price 5s. per 100, post free.

THE USE OF SULPHATE OF AMMONIA AS A MANURE. By WILLIAM ARNOLD, Chairman of the Tamworth Gas Company. Price 2s. 6d. per 100, post free.

Published by WALTER KING, 11, Bolt Court, Fleet Street, LONDON, E.C.

MR. W. H. BENNETT having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their Inventions may be secured for Twelve months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

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Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

THE

GUIDE-FRAMING OF GASHOLDERS

AND OTHER PAPERS

CHIEFLY RELATING TO

STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS.

BY

F. SOUTHWELL CRIPPS, Assoc. M. Inst. C.E.

Reprinted from the JOURNAL OF GAS LIGHTING. *Fully Revised and Corrected by the Author, with many Additions.*

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Yield of Gas per Ton, over 12,000 Cubic Feet.
Illuminating Power - - - - - 26 Candles.
Coke per Ton, - - - - - - - 57 per cent. of a quality almost equal to that made from the best Coking Coal.

For Analysis and Price, apply to

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NEWBATTLE COLLIERIES,

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Produce of Gas per ton - - - - - - - 10,500 feet.
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Illuminating Power - - - - - - - 16 candles.

For Prices, f. o. b. Ship or delivered, apply to

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SEARCHES made *re* novelty, and opinions given on all matters connected with above. *Full particulars on application to*

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Special experience in Gas and Ammonia Plant.

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Near HALIFAX,

MANUFACTURER OF SULPHURIC ACID

OF EXTRA QUALITY FOR MAKING

WHITE SULPHATE OF AMMONIA.

TAR, LIQUOR, AND SPENT OXIDE Purchased for Cash against Delivery.

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Manufacturers of the **"Thomas"** Patent Lamps for general lighting, also for Public Buildings, Institutions, &c., and for outside purposes.

The best Regenerative Lamp in the Market.

Special quotations to Gas Companies.

Now Ready, Price 6s., bound in Cloth.

THE CHEMISTRY OF ILLUMINATING GAS.

By NORTON H. HUMPHRYS, Assoc. M. Inst. C.E., F.C.S.

The matter composing this book consists mainly of articles written for, and published in, the JOURNAL. The preface says: "In view of new processes that seem to fall in thick and fast one on the other, it has been several times suggested that they should be collected together, so as to form a record of the various gas-making processes that have been proposed in the past, together with some account of the natural laws that govern the manufacture and supply of Illuminating Gas."

The work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas-Making; Destructive Distillation Condensation; and Purification.

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PRICES REDUCED.
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New Design, with two Cutting Rollers, making less Breeze than their old pattern.
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Manufacture and keep in Stock at their Works (also large stock in London)
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STEEL OF ALL DESCRIPTIONS.
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HUNDREDS OF SETTINGS WORKING EMINENTLY SATISFACTORY.
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ORIGINAL MANUFACTURERS OF DRY METERS IN CAST-IRON CASES.
STATION METERS, EXPERIMENTAL METERS, PHOTOMETERS, & PRESSURE-GAUGES, &c.

Results of Tests of Dry Gas-Meters (Section III.) of the Glasgow Philosophical Society's Gas Exhibition, as per London "Gas Journal," May 10, 1881.

	ALDER & MACKAY.	W. & B. Cowan.	G. Glover & Co.	James Keith.	D. B. Peebles & Co.
Total of Fast Tests . .	47·2	6·9	33·6	62·3	53·7
Total of Slow Tests . .	25·3	117·4	43·1	31·4	38·5
	72·5	124·3	76·7	93·7	92·2

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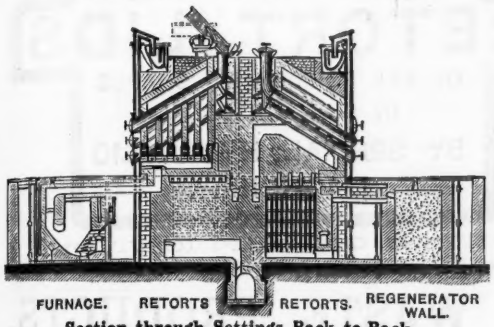
Descriptive Circulars, Price Lists, and Full Particulars forwarded on application.
NEW GRANGE WORKS, EDINBURGH.

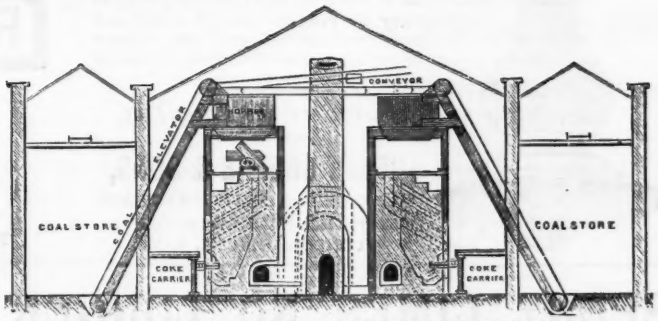
AUTOMATIC SYSTEM OF
CHARGING & DRAWING INCLINED GAS-RETORTS.

Gold Medal, Paris Exhibition, 1889.

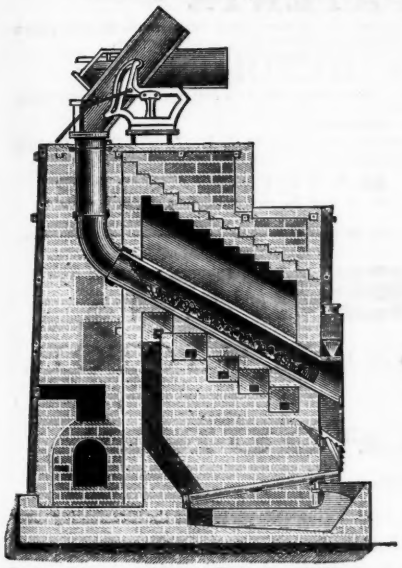
This System of Automatically Charging and Discharging Retorts without machinery or arduous labour is in operation at several places on the Continent and in America, and will shortly be at work in various Gas-Works in England.



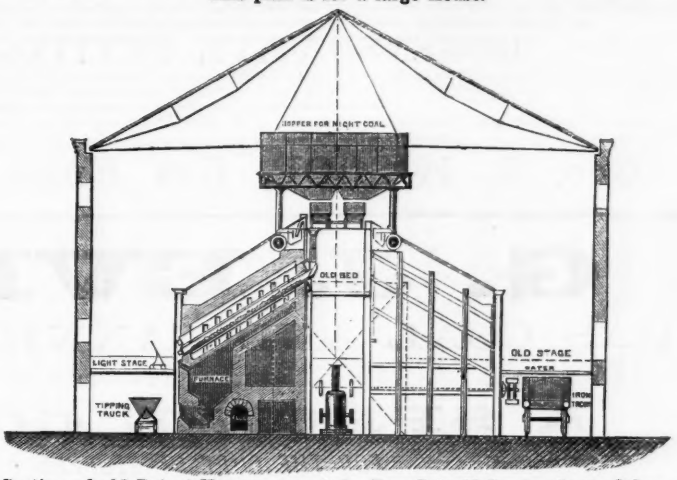
Section through Settings Back to Back. Working off ground floor with Generator under Stage and Regenerator under the Sets.



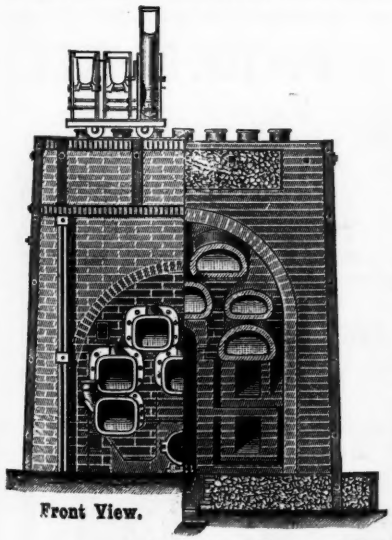
Transverse Section of House with Coze's Single Settings, Showing Method of working Two Single Settings and Distributing the Coal to the Supply Hoppers; the whole of the work being Automatic. This plan is for a large House.



Section through Middle Retort and Furnace.

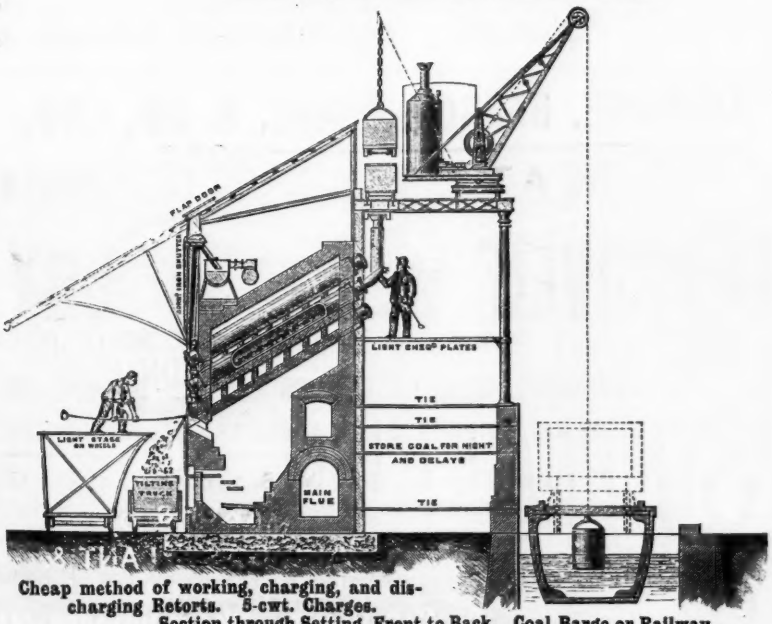


Section of old Retort-House converted, Two Sets 20 fts. in place of One. Modified form, with ordinary Retorts and Fittings.



Front View.

Section through Furnace & Bed.



Cheap method of working, charging, and discharging Retorts. 5-cwt. Charges. Section through Setting, Front to Back. Coal Barge or Railway. Light Corrugated Roof over Sets and at Sides.

These Systems are fully Patented, and any Infringer will be strictly proceeded against.

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Hislop's Patent Producer and Patent Charging Appliances offer advantages which are unapproachable, while in every other detail his Settings are confidently recommended as being the most inexpensive and effective possible.

Illustrated Pamphlet and Terms on application to J. E. FISHER, Stourbridge, Agent for England and Wales; to C. M. HAMILTON, Portland Place, Hamilton, Agent for Scotland and Ireland; and for all other Countries to the Patentee,

Geo. R. HISLOP, Gas Engineer, PAISLEY, N.B.

G. J. EVESON,

GAS COAL AND CANNEL CONTRACTOR,

PATENTEE OF

A SPECIAL COMPOUND

FOR THE CURE OF STOPPED ASCENSION-PIPES,

A couple of charges of which will clear a stopped pipe, and an occasional charge keeps them clean, and also increases the make per ton and the illuminating power

PRICE AND PARTICULARS ON APPLICATION.

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Quotations and Analysis on application to

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Shipping Ports: All the principal Scotch Ports.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production nearly 3000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves 69 per cent. of excellent Coke. During the year 1890, the London Gas Companies carbonized about 400,000 tons of HOLMSIDE COALS. They are used by The Gaslight and Coke Company, the South Metropolitan Gas Company, the Woolwich (Government) Gas-Works, the Newcastle and Gateshead Gas Company, the European Gas Company, L'Union des Gaz, and by many other Gas Companies both at Home and Abroad.

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Gas Companies are solicited to try Samples of the
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Prices and Analysis on application.
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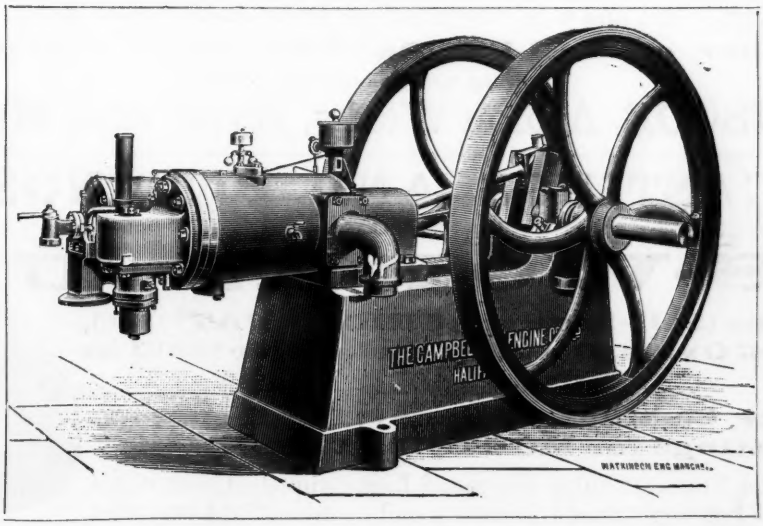

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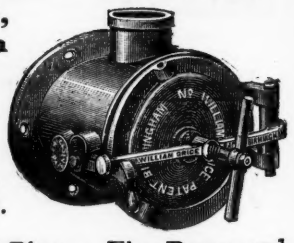

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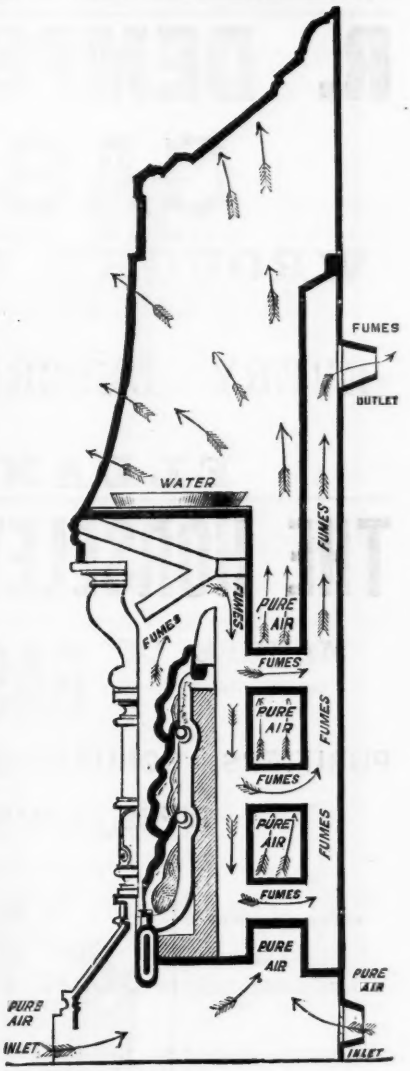

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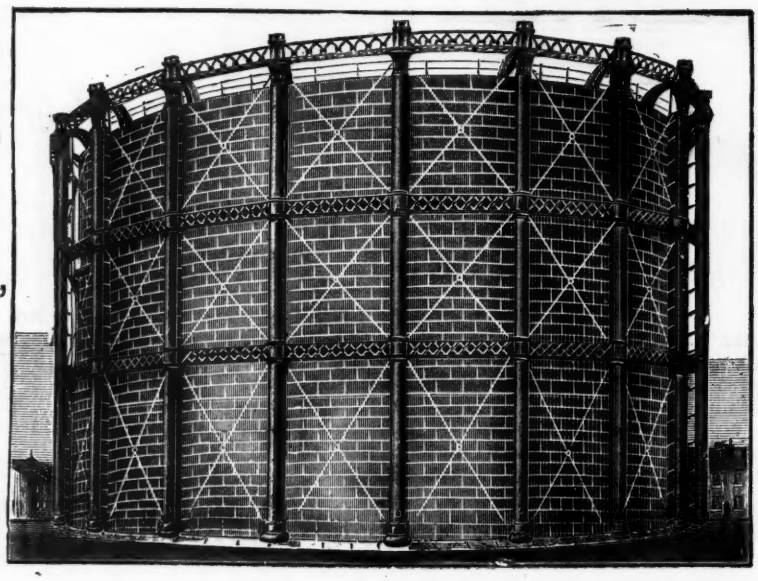

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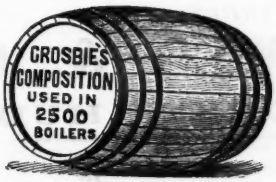

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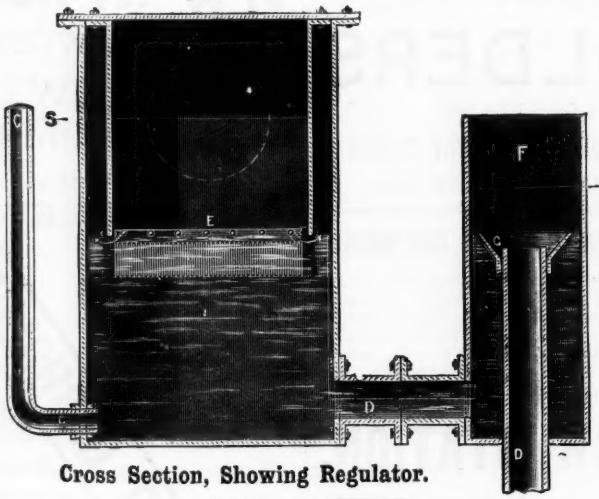

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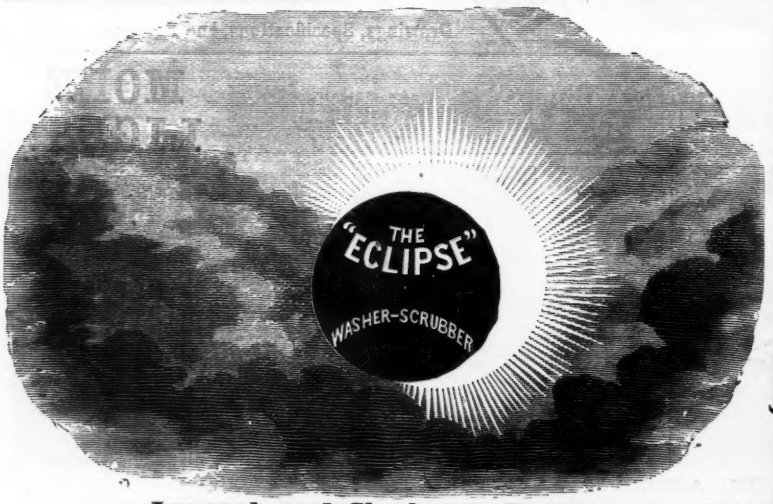

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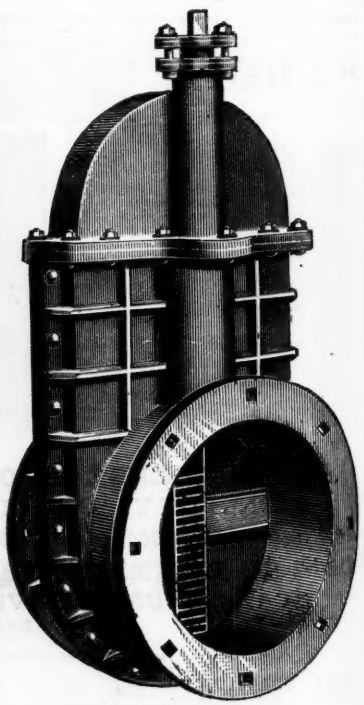

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